01dB Smart Building Acoustics Solution

User Manual

Brand of ACOEM

01dB Smart Building Acoustics Solution User Manual

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Welcome to the world of 01dB

ACOEM would like to thank you for purchasing this 01dB product and invites you to refer to this user manual. For more information on ACOEM's products and services, please visit www.acoemgroup.com.

Receipt of your equipment

This product was carefully inspected and tested prior to shipping. Nevertheless, you are requested to check when opening the packaging that there is no sign of damage and that all the accessories are included. If this is not the case, please notify ACOEM or its approved representative without further delay. You are advised to keep the packaging in case you need to return your equipment for maintenance at ACOEM's premises.

Warranty

For this 01dB product, ACOEM offers a 24-month warranty for parts and labor, against all manufacturing defects, with free shipment to return the equipment to ACOEM. Any defects or damage caused by normal wear or resulting from negligence (poor supervision, maintenance or storage conditions, misuse of product, etc.) or arising from modifications that are not allowed for nor specified by ACOEM are excluded from the warranty. Up to the expiry date of the warranty period, ACOEM undertakes to rectify any defect that adversely affects the normal operation of the product and that fails within the scope of this warranty. In the event that such a defect should arise, you should inform ACOEM is writing without delay, including any information liable to be useful in diagnosing the nature of the defect and providing all supporting data as to the existence of the defect.

Further information

For further information:

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- Follow us on Facebook: http://fr-fr.facebook.com/pages/Acoem
- Follow us on LinkedIn: www.linkedin.com/company/acoem
- Contact our Customer service Department by e-mail at support@acoemgroup.com

Chapter 1
INTRODUCTION

The field of building acoustics is governed by a complex set of measurement and calculation standards for assessing the acoustic performance of buildings. Various equipments are required to make a measurement (sound level meters, sound sources, tapping machine,…) and may well need several people. Furthermore, the equipment must be moved around the building repeatedly to carry out a measurement campaign. A rigorous approach is thus essential in order to conduct a campaign efficiently.

01dB Smart Building Acoustics Solution enables building acoustics technicians to enhance their productivity in the field and also in the office. The 01dB solution comprises a embedded module in a sound level meter (FUSION or DUO), dBInside software running on a PC, a sound source and a tapping machine (LS01, LS02, TM01, etc.). Each component of the solution is designed to eliminate superfluous actions, avoid errors and optimize work through smart organization of measurements, automatic identification of each measurement, on-the-fly calculation of standardized indicators when the measurements are imported into dBInside, a one-click automatic report in Microsoft® Excel, and all-in-one noise sources for easier transportation and use!

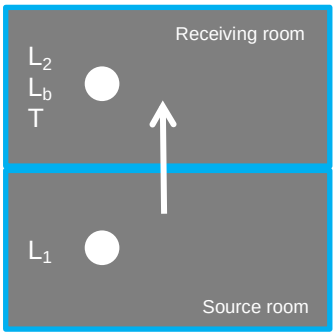
This user manual is dedicated to Building Acoustics option. If you are a new user of 01dB ecosystem, we strongly recommend studying the user manual of you instrument first.

Chapter 2
ORGANIZATION OF THE TESTS

2.1 BUILDING ACOUSTICS: A QUICK OVERVIEW

In building acoustics, ratings are calculated on the basis of a set of measurements made on site. Typical ratings include the insulation of a wall or the sound level of equipment noise. For example, determining the airborne sound insulation provided by a ceiling between two rooms (vertical insulation) will involve at least four measurements:

- L1: Noise level in the source room (where the noise source is located) while the noise source is operating.
- L2: Noise level in the receiving room while the noise source is operating.
- Lb: Background noise in the receiving room when the noise source is not operating.
- T: Reverberation time in the receiving room.

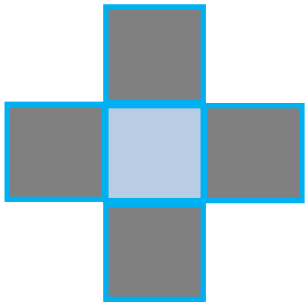


More measurements may be required for averaging (several locations in each room) depending on local legislation and standards, but the principle remains the same.

All the measurements results have one thing in common: the receiving room. This is a strategic element of the measurement process and, most importantly, productivity can be increased by an appropriate choice of receiving room. Three of the measurements (L_2, L_b and T) are taken in this room, and two of them (L_b and T) can be reused for different types of measurement results (airborne noise insulation or impact noise level, receiving of equipment noise, etc.). These measurements can thus be reused in several tests without needing to repeat them!

2.2 DECIDE HOW YOU MEASURE

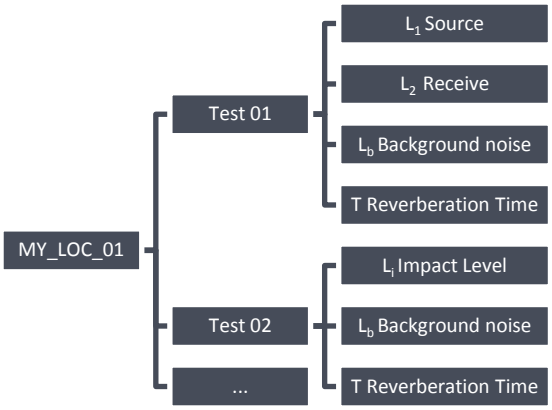
As part of the preparation for a measurement campaign, acoustic consultants need to select measurement configurations that are expected to be representative within the building and also those most at risk in terms of non-conformance. The final choice often focuses on a group of rooms in a cross arrangement, in which all receiving measurements are taken in the central room.



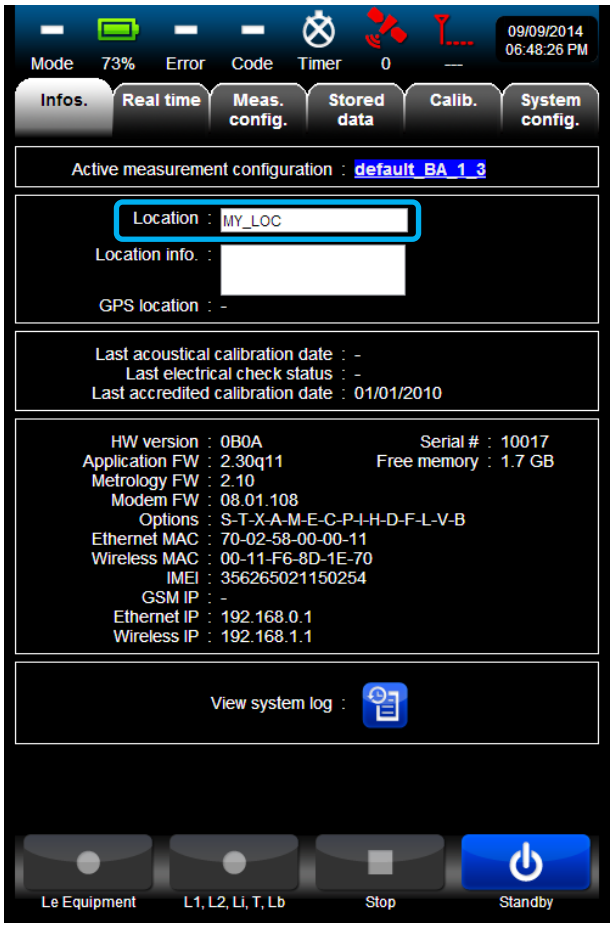
Accordingly **01dB** has decided to organize measurements around this receiving room.

2.3 DESCRIPTION OF THE DATA ORGANIZATION

The measurement campaign in the embedded “Building acoustics” module for **FUSION** and **DUO** is organized as follow:



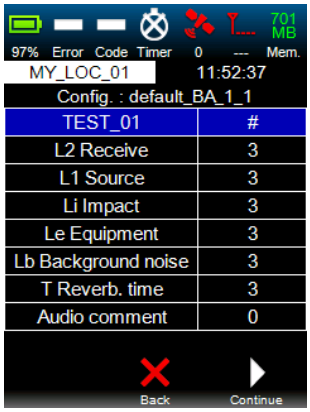
The main location name is defined and can be edited in the info tab of the web interface and we advice to let it correpond to the building block to be measured:



The measurement campaign MY_LOC groups a number of “Test” containers, each of which will contain the measurements qualifying one device. This is where the power of the **01dB** solution comes into play: there is only one constraint on the test container, namely that it must refer to a single receiving room. The device under test can be for instance a partition, a façade, a ceiling, better: the complete set of data that can have a common receiving roomor simply a series of reverberation time decays.

In the example below, the project is called MY_LOC_01 and the TEST_01 container contains three measurements of:

- Source levels
- Receive levels
- Impact noise levels
- Equipment noise levels
- Background noise levels
- Reverberation times



On this basis, **dBInside** software will automatically calculate the standardized rating values without assistance from the user.

2.4 CREATION OF THE DATA STRUCTURE AS YOU MEASURE

The data structure is created using the integrated user interface as you measure:

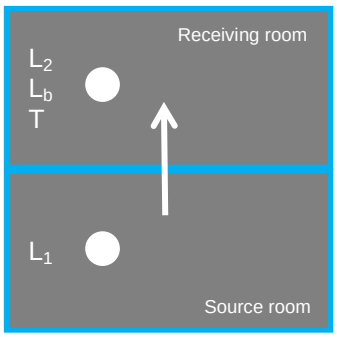
- Automatic increment of the location
- Automatic increment of the test #

All details of the increment are given in §6.3: integrated user interface details

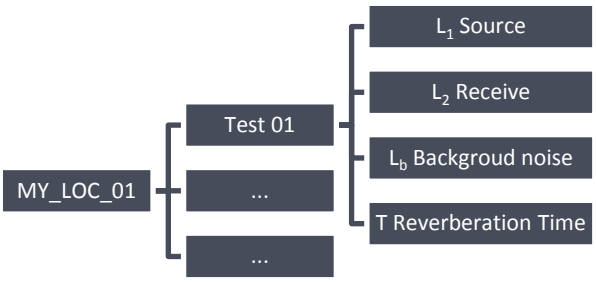
2.5 ADVANTAGES OF THIS DATA ORGANIZATION

The user of the **01dB** solution can opt for various measurement possibilities:

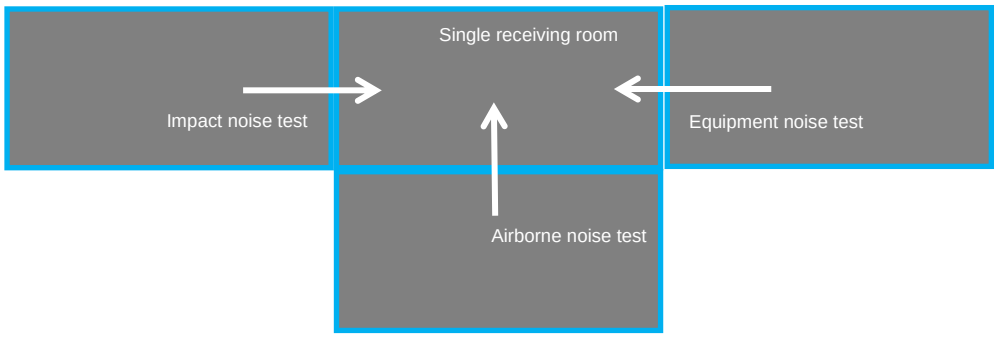
Case 1; individual test: The user chooses to store a single test in the test container (see diagram below). For airborne sound insulation for instance, four measurements will be performed (L_1, L_2, L_b and T) and stored in “Test 1”. When the data is uploaded to **dBInside**, the program will directly recognize an airborne sound insulation test and will directly calculate the standardized value as a function of the selected default standard.



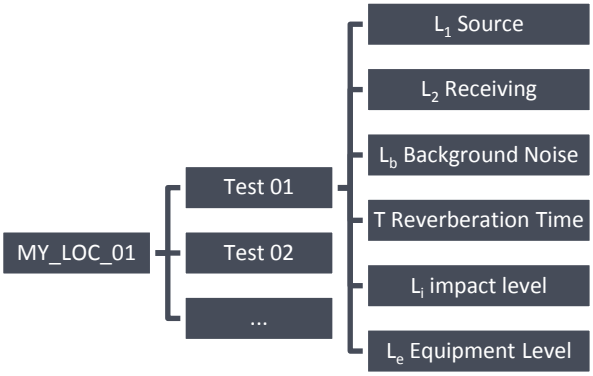
The organization in the instrument is shown in the diagram below:



Case 2; common receiving room: The user chooses to conduct several tests of different types (airborne, impact, equipment), all with the same receiving room (see diagram below).



The organization in the instrument is shown in the diagram below:



The advantage of this configuration is that, when the data is transferred to **dBInside**, the program will separate the container into three individual test results:

- One airborne sound insulation test
- One impact noise level test
- One equipment noise level test

For each test, **dBInside** program uses the same background noise and reverberation time measurements. The three rating values will be calculated on the fly once the measurements have been uploaded into the program.

Note: If the user needs to perform several measurements of the same type in a room (e.g. several source levels), **dBInside** program will automatically (without user intervention) calculate the average of the measurements of the same type.

Case 3: The user can also decide to place all these measurements in a single test container with different receiving rooms. This solution will require the user to assign each measurement to a test in **dBInside** program. This solution is not recommended by **01dB**.

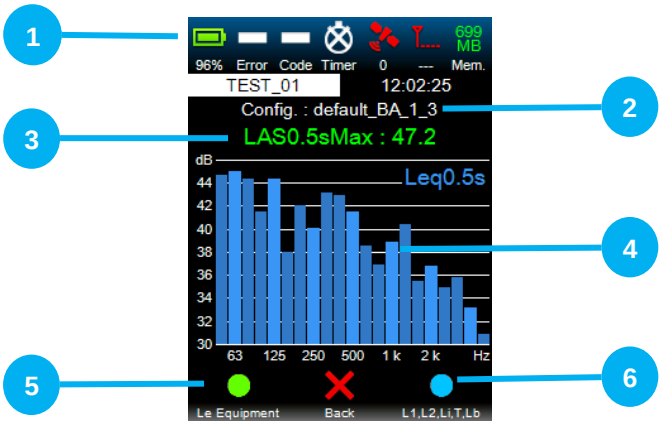
Chapter 3
INTEGRATED INTERFACE

3.1 SIMPLICITY FIRST AND FOREMOST

The information displayed on the screen of a sound level meter must be designed with care. While it is possible to display a multitude of information, it is preferable to be selective and show only the information that is most important for the user, to avoid having an adverse effect on productivity.

The **01dB** solution gives the user access to essential information:

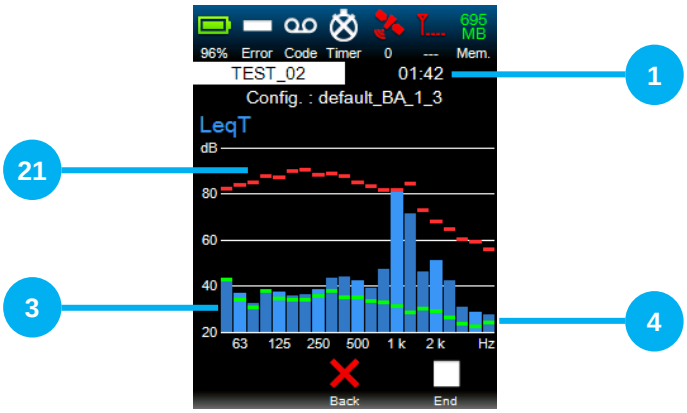
01 – Status bar (identical to environment mode)
02 – Name of configuration used
03 – Global acoustic indicator
04 – Instantaneous spectrum (for one-third octave measurements, the light blue indicates the central frequency)
05 – Equipment noise measurement selection
06 – Multispectrum measurement selection (source, receive, background noise, reverberation time)



3.2 MULTISPECTRUM MEASUREMENT

If a multispectrum measurement type is selected (button), the user can display the following data while the measurement is in progress:

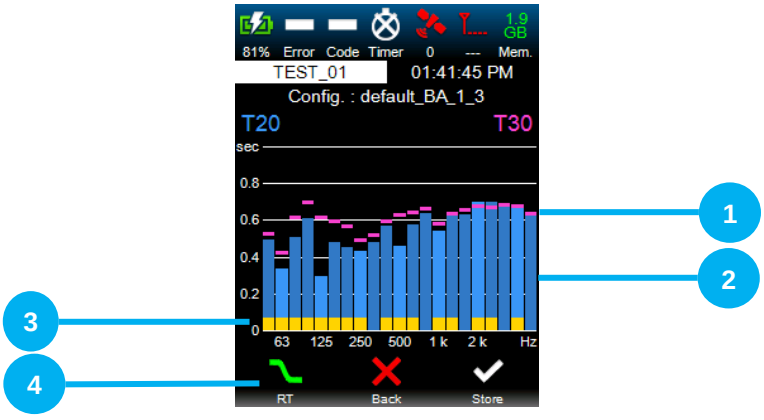
01 – Measurement countdown
02 – Maximum spectrum (red lines)
03 – Instantaneous spectrum (blue bargraph)
04 – Minimum spectrum (green lines)



3.3 REVERBERATION TIME

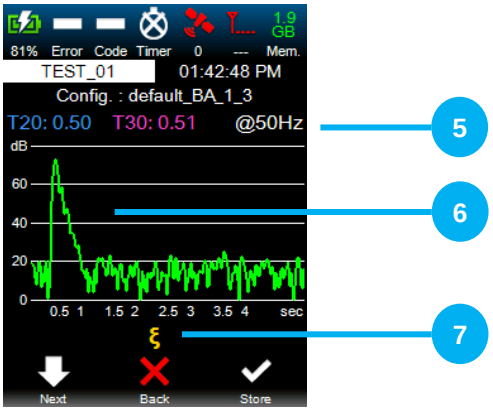
After a reverberation time measurement, the screen below is displayed showing the user all relevant information:

01 – In pink, the reverberation time T30
02 – In blue, the reverberation time T20
03 – In yellow, if at least one ISO 3382 indicator is not met
04 – Access to decay information



Pressing the decay button displays the decay data for each frequency band measured, with non-compliance indicator(s) including ISO 3382:

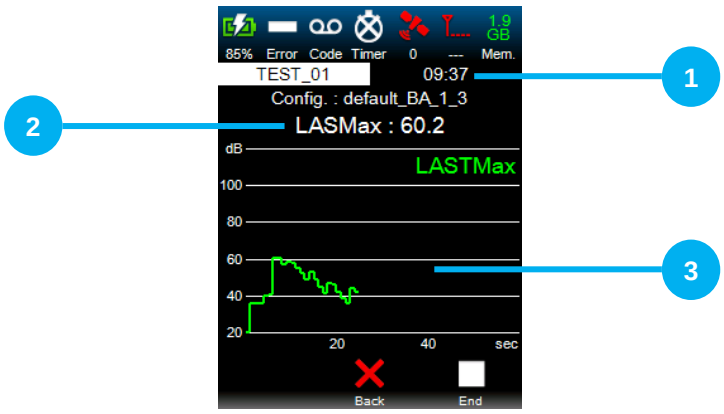
05 – Frequency band considered
06 – Decay
07 – ISO 3382 non-compliance indicator(s)



3.4 EQUIPMENT NOISE

If an equipment noise measurement type is selected (button), the user can display the following data while the measurement is in progress:

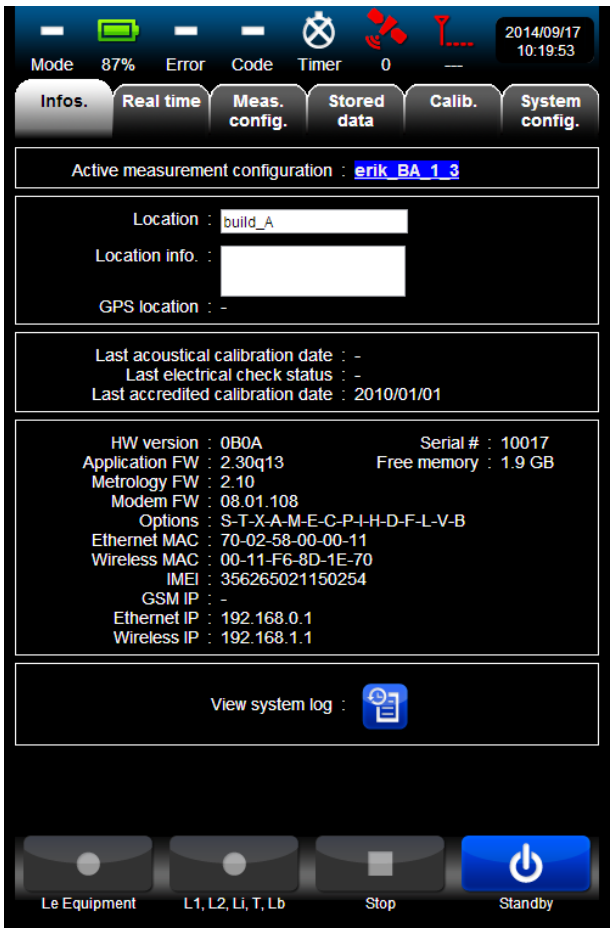
01 – Measurement countdown
02 – Measured LA_{smax}
03 – Time history of LA_s



Chapter 4
WEB INTERFACE AND REMOTE CONTROL

4.1 WEB INTERFACE (ACTIVE WHEN NOT IN "READY FOR MEASUREMENTS" MODE)

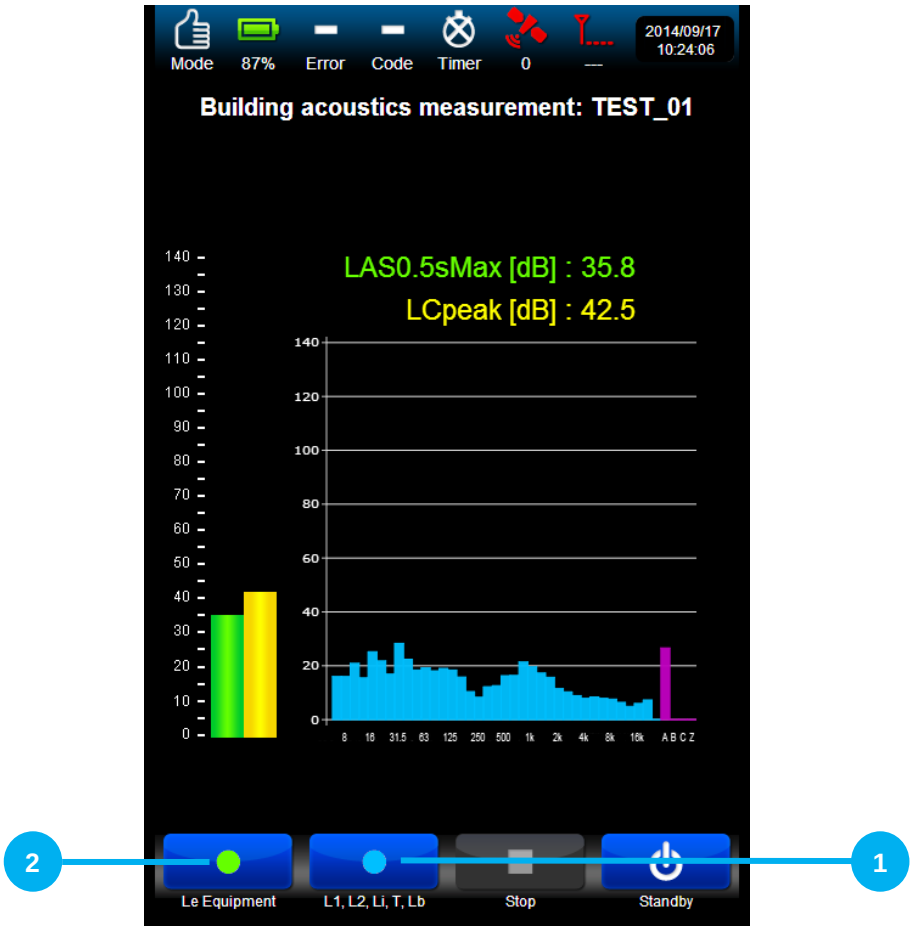
The **FUSION** and **DUO** sound level meters include an embedded Wi-Fi module that can be used to operate remotely via a dedicated web interface. Using a smartphone, tablet or computer, when not in "ready for measurements" mode activated (refer to § 6.3.5) from the integrated interface, the user can access all information, configurations, calibration and data:



4.2 REMOTE CONTROL OF FUSION AND DUO (ACTIVE WHEN IN "READY FOR MEASUREMENTS" MODE)

When in "ready for measurements" mode activated (refer to § 6.3.5) from the integrated interface, the user can use the web interface as a remote control for start, view and stop current measurements: *01*

01 – Start a multispectrum measurement
02 – Start an equipment noise measurement



For additional information refer to § 6.4 Web interface (active when not in "ready for measurements" mode) and 6.5 Remote control of FUSION and DUO (active when in "ready for measurements" mode)

Chapter 5
BUILDING ACOUSTICS ACQUISITION MODE SETUP

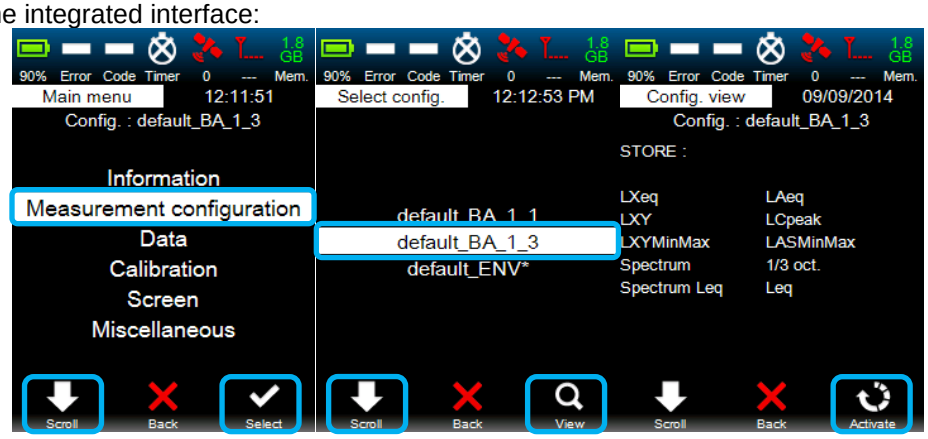
5.1 ENTER THE BUILDING ACOUSTICS MEASUREMENTS MODE

The principle for activating the building acoustics measurements mode is to select a building acoustics measurement setup. Three default measurements setup are installed in the instrument:

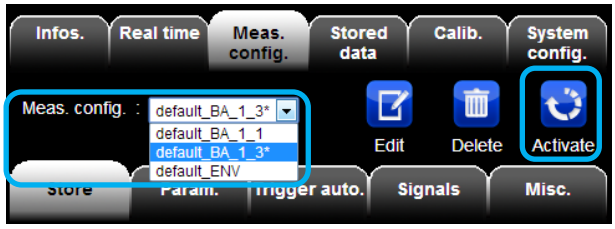
- default_ENV: corresponds to the default Environmental configuration (for more information, please refer to your instrument user manual)
- default_BA_1_3: corresponds to the default Building acoustics configuration for 1/3 octave analysis
- default_BA_1_1: corresponds to the default Building acoustics configuration for 1/1 octave analysis

To enter the building acoustics mode, select and activate a default_BA_1X configuration ; to measure in 1/3 (resp. 1/1) octave, select default_BA_1_3 (resp. default_BA_1_1) configuration.

- From the integrated interface:



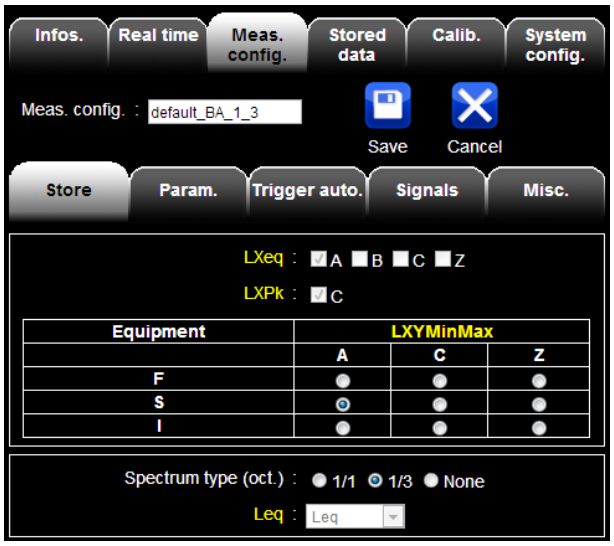
- From the web interface:



5.2 BUILDING ACOUSTICS MODE MEASUREMENT SETUP

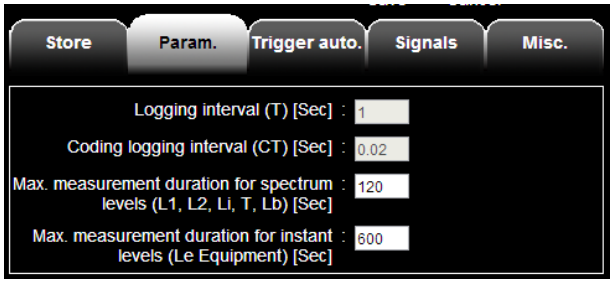
The parameters can be modified using the web interface from the default_BA_1X measurement configuration in edit mode by pressing edit :

5.2.1 *Store tab*



LXeq: fixed and A weighting selected: broadband value LAeqT will be stored, T being the logging and fast logging periods (see Param. tab below). B, C and Z values are not selectable.
LXPk: fixed C weighting peak value selected
Equipment: one overall value out of the 9 possible ones in the table is selectable. Default is **LASMinMax**; this overall value is stored in time history at logging and fast logging periods.
Spectrum type (oct): either 1/1 or 1/3
Leq: Leq fixed and selected: it means the stored spectra are based on Leq

5.2.2 *Param. tab*


Store
Param.
Trigger auto.
Signals
Misc.
Logging interval (T) [Sec] : 1
Coding logging interval (CT) [Sec] : 0.02
Max. measurement duration for spectrum levels (L1, L2, Li, T, Lb) [Sec] : 120
Max. measurement duration for instant levels (Le Equipment) [Sec] : 600

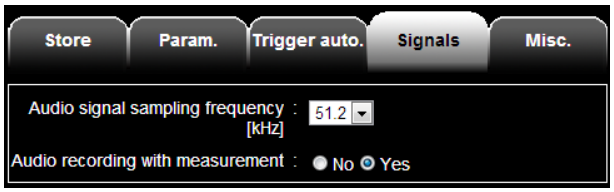
Logging interval (T) [Sec]: logging period for broadband and spectra data; fixed at 1 sec.
Coding logging interval (CT) [Sec]: fast logging period for broadband and spectra data; fixed at 20 msec.
Max. measurement duration for spectrum levels (L1, L2, Li, T, Lb) [Sec]: measurement duration for spectrum levels; can be selected from 8 sec. to 600 sec. default is 120 sec.
Max. measurement duration for instant levels (Le Equipment) [Sec]: measurement duration for instant levels; can be selected from 8 sec. to 600 sec. default is 600 sec.

5.2.3 *Trigger auto tab*

This tab allows the modification of the default parameters for advanced recognition.
Refer to § Chapter 7: Automatic measurement type recognition for more information.
Please note that the modification of these parameters can alter the automatic recognition process; it is therefore necessary to perfectly understand the mechanism before making any change.

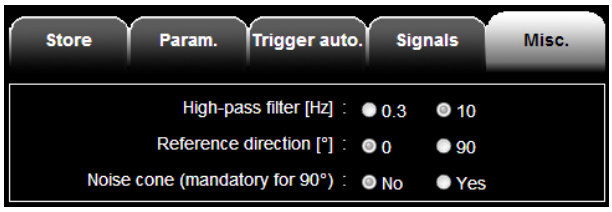
Event # : 5 events are activated and cannot be deleted
Code : 5 codes are defined; one for each event
Fast logging: always Yes
Logic for triggers: And or Or; if several triggers are defined
Trigger # : number of the trigger
Trigger type : selection of the data to be used for trigger
Start trigger [dB]: level for trigger start
End trigger [dB]: level for trigger stop
Pre-trigger [Sec]: buffered time before trigger starts
Post-trigger [Sec]: minimum delay before trigger stops
Minimum time duration [Sec]: minimum duration for a trigger to start
End duration [Sec]: time duration after end trigger level to stop the trigger

5.2.4 *Signals tab*



Audio signal sampling frequency [kHz]: selection of the audio sampling frequency; selectable among 51.2; 25.6; 12.8; 6.4; 3.2 and 1.6 kHz. Default value is 12.8 kHz
Audio recording with measurement: No or Yes; default is Yes (only if option A is active)

5.2.5 *Misc tab*



This menu can be used to set up the type of metrological configuration; input filter and reference direction.

High-pass filter [Hz]: allows selecting the high-pass input filter; either 0.3 Hz, or 10 Hz. In order to avoid saturation of the input stage by very low frequency signals (such as the slamming and blowing of a door closing), one must use the 10Hz cut-off filter. On the opposite, the analysis of very low frequency signals requires using the 0.3 Hz filter (used as a 1/3 octave filter for instance).

Reference direction [°]:

For FUSION:
With internal input selected:
- 0° (selected and greyed when internal input selected) corresponds to the classic free-field response configuration.

With external input selected:
- 0° corresponds to the classic free field response configuration
- 90° corresponds to using the the DMK01 mounted in vertical position during noise measurements with “ground sources”, such as, e.g., ground transportation noise (typical setup for façade measurements.

For DUO:
With internal input selected:
- 0° corresponds to the classic free-field response configuration where the instrument is placed towards the source axis use of 40CD microphone.
- 90° corresponds to the instrument mounted vertically during noise measurements. This configuration is an interesting alternative in building acoustics measurements because it better takes into account diffuse field.

With external input selected:
- 0° corresponds to the measurement configuration for aircrafts noise, DMK01 mounted vertically
- 90° corresponds to using the instrument placed in a vertical position during noise measurements with “ground sources”, such as, e.g., ground transport noise.

Nose cone (mandatory for 90°): the user can select or not select the cone for 0° reference direction. In this case in order to take its influence into account properly it is necessary to select its presence or not BEFORE the measurement is performed. For 90° reference direction the user HAS to use the cone in order to fulfil directivity criteria of ISO 61672-1.

5.3 STORED DATA

5.3.1 *Instantaneous data*

The following data are stored at the end of a measurement:

5.3.1.1 Logging period T=1sec.:

- LAeqT
- LCPk
- LXYTMin and LXYTMax
- Spectrum LeqT

5.3.1.2 Fast Logging period T=20msec. when an event is ongoing:

- LAeqT
- LCPk
- LXYTMin and LXYTMax
- Spectrum LeqT

5.3.2 *Averaged spectrum data*

- Averaged receive spectrum; calculated while event 1 is ongoing
- Averaged source spectrum; calculated while event 4 is ongoing
- Averaged impact noise spectrum; calculated while event 3 is ongoing
- Averaged background noise spectrum; calculated on the whole measurement duration

Note: if the user modifies manually the predefined recognized measurement type, the average spectrum is calculated on the whole logging period.

5.3.3 *Reverberation time data*

- T20: calculated reverberation time spectrum based on 20 dB dynamic range (start at -5dB below average level before sound source stops)
- T30: calculated reverberation time spectrum based on 30 dB dynamic range (start at -5dB below average level before sound source stops)
- Result passed/not passed of the following indicators for each frequency band:

Name	Quality indicator	Description, default values
N	Background noise level too high*	Low dynamic range (T20 between 31-35 dB)
D	Calculation impossible*	Insufficient dynamic (< 41 dB for T30; < 31 dB for T20)
<	Reverberation time too low*	Tr < 0.24 seconds (scaled by logging period = 20 ms)
ξ	Non-linearity*	Non-linearity parameter ξ >1%
C	Curvature*	C > 10% or C < 0
L	Linearity of the sound source	Difference between adjacent 1/1 or 1/3 octave bands > 6 dB

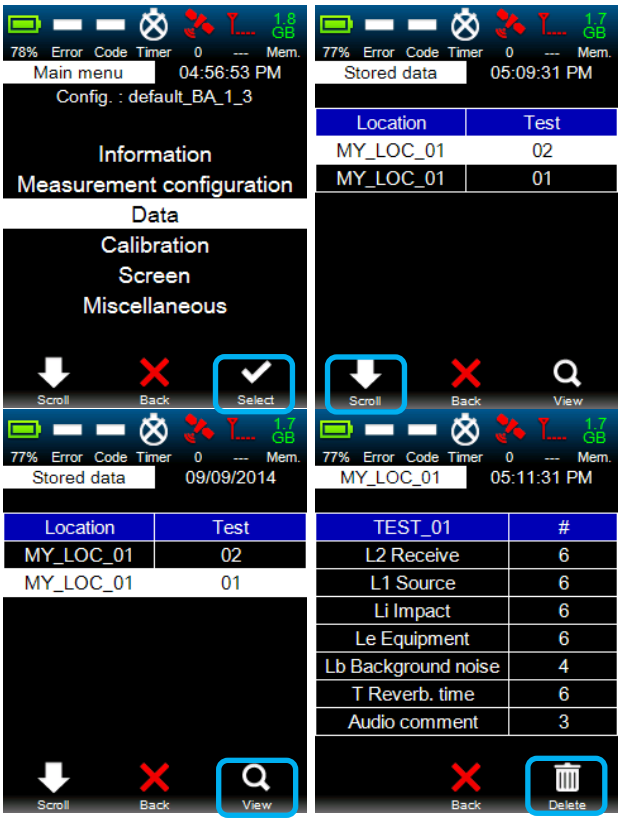
*: ISO 3382-2 standard indicator

5.3.4 *Audio recording*

Audio recording is stored as soon as a measurement is performed and can be reused for audio playback.

5.3.5 *Integrated interface data list menu*

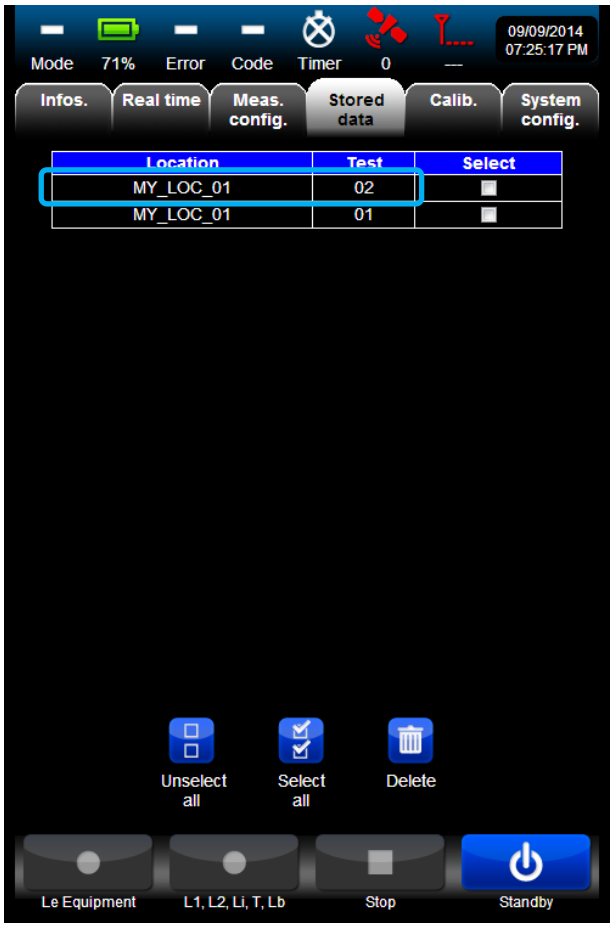
The Data menu gives access to the list of the different measurements stored on the SD card; data is sorted by time of measurement, from the earliest to the oldest:



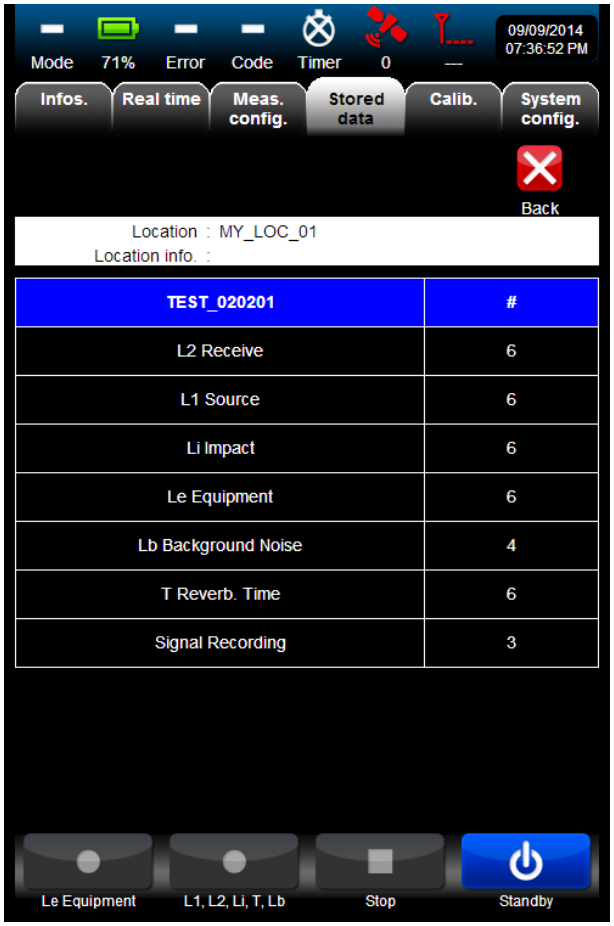
Note: it is only possible to delete complete set of tests: in the example above, all measurements contained in TEST_01 will be deleted when pushing the button Delete

5.3.6 *Web interface data list menu*

The Data menu gives access to the list of the different measurements stored on the SD card; data is sorted by time of measurement, from the earliest to the oldest.



Selecting one or several lines will delete the complete sets of measurements contained in these tests when Delete button is pushed.
Clicking on the line corresponding to the test of interest gives access to the all tests contained in the selected test:


Mode
71%
Error
Code
Timer
0

09/09/2014
07:36:52 PM
Infos.
Real time
Meas. config.
Stored data
Calib.
System config.
Back
Location : MY_LOC_01
Location info. :
TEST_020201
#
L2 Receive
6
L1 Source
6
Li Impact
6
Le Equipment
6
Lb Background Noise
4
T Reverb. Time
6
Signal Recording
3
Le Equipment
L1, L2, Li, T, Lb
Stop
Standby

Chapter 6
BUILDING ACOUSTICS MEASUREMENTS

6.1 PRINCIPLE

The measurements are performed from 50 Hz to 5 kHz (1/3 oct) or from 63 Hz to 4 kHz (1/1 oct. the selection of the analysis bandwidth is made in post-processing

6.2 PREREQUISITE ON THE USE OF SOUND SOURCE AND TAPPING MACHINE

01dB has decided on purpose to design a system that does not trigger by remote control a sound source or a tapping machine. It is the source that triggers the instrument, not the instrument that triggers the source!
The reasons for this decision are:

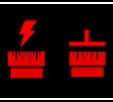
- No need to purchase a source compatible with the system, you can use your existing sources
- No need to establish on site a wireless communication between the sound level meter and the source

Therefore the user simply has to turn on the source, either before or after the measurement has started. Nevertheless we recommend to turn the source on always before starting a measurement; in that way the sound field has time to be established when the measurement starts (except for a measurement of impulsive reverberation time, where in that case the measurement needs to be started at least 1 sec before the impulse).

6.3 INTEGRATED USER INTERFACE DETAILS

6.3.1 *Summary of icons and buttons*

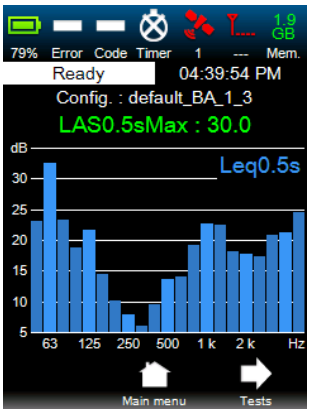
01 – Explicit icons commands
02 – Corresponding buttons for the command

Symbol	Explanation	Symbol	Explanation
	Activate		Activate disabled
	Back to previous menu		Back to previous menu disabled
	Calibration		Calibration disabled
	Checking ON		Electrical check error
1	Code 1 / Code 1 OFF	1	Code 1 disabled
1	Code 1 ON	2	Code 2
3	Code 3	4	Code 4
5	Code 5	A	Auto Code
–	No code		
	Trash		Trash disabled
	Recording multispectrum		Recording multispectrum disabled
	Recording equipment		Recording equipment disabled
	Stop		Stop disabled
	Activate		Activate disabled
	Pull-down list		Pull-down list disabled
	Validation / OK		Validation disabled / OK disabled
	Full battery		Empty battery
	Battery is charging		Access to the tests list

Symbol	Explanation	Symbol	Explanation
	Programming ON		Programming active soon
	Programming OFF		Overload
	GPS OK		GPS not OK
	Communication OK		Communication not OK
	Memory status		Continue from Tests list to measurements
	Main Menu		Main Menu disabled
	Display		Display OFF
	Display decay		Display decay disabled

6.3.2 *Ready mode*

This is the default display when the instrument is turned on.

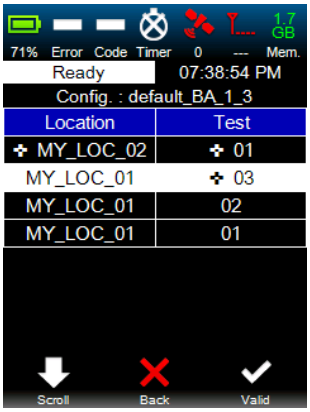


By pressing Main menu it gives access to the main menu.
The menu Data differs from the environmental application
For more information on the other menus please refer to the instrument user manual.

By pressing the button Tests it gives access to the tests list:

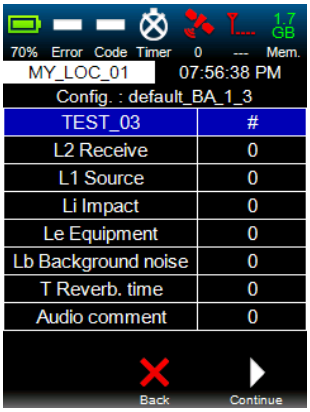
6.3.3 *Tests list*

- The symbol represents creation of a new Location and/or Test.
- Locations are sorted by time from the newest to the oldest
- Tests are sorted by time, from the newest to the oldest
- The select field is systematically positioned on the second line. It means the user remains in the same location but is about to start a new test (Test_03) when pressing the Valid button.



6.3.4 *Test content information*

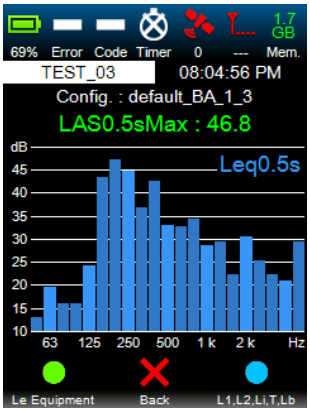
Once the location & test is selected, the test content information display describes the number of already measured data in that selected location & test:



In that case, a new test (TEST_03) has been created (no measurement inside)

By pressing Continue , the user has access to the ready for measurements display:

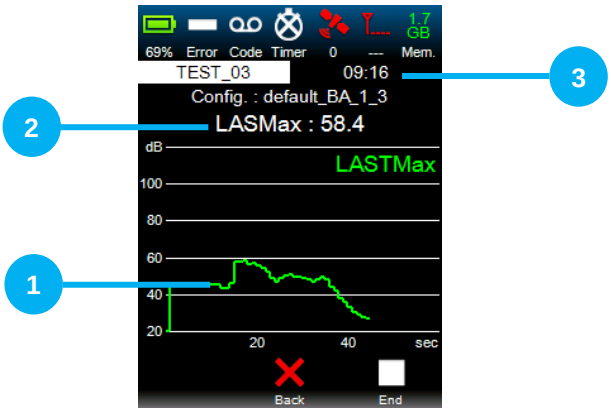
6.3.5 *"Ready for measurements" mode*



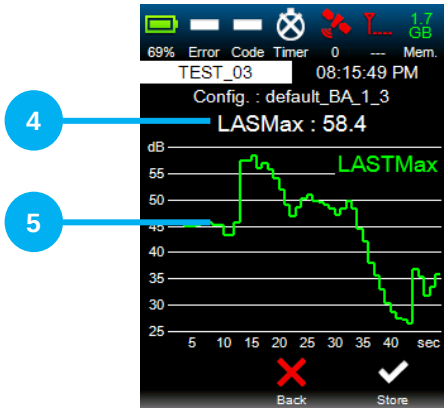
- Le Equipment button starts the equipment measurement mode: the instrument logs the time history and stores the LXYMinMax selected in the measurement setup (refer to § 5.2.1 Store tab)
- L1, L2, Li, T, Lb button starts the multispectrum mode.

6.3.5.1 *Recording equipment noise mode (detection of LXYMax over the time history)*

Once the Le Equipment button pressed, the instrument starts the measurement and displays
01 - time history of LXYTMax ,
02 - maximum hold value LXYMax)
03 - countdown



By pressing the End button, the instrument displays :
04 - maximum hold value LXYMax .
05 - overall time history of LXYTMax auto scaled

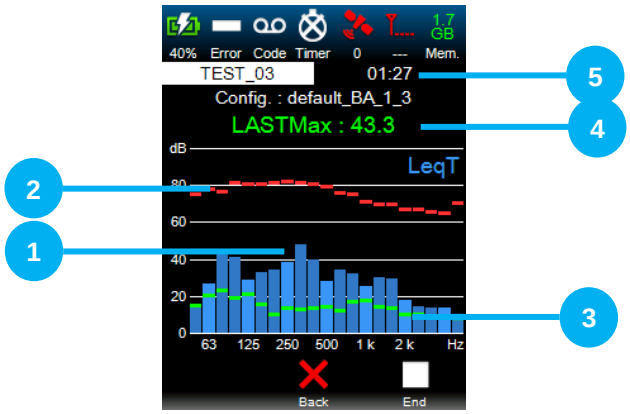


By pressing the Store button the instrument stores the measurement on the SD card and the instrument is back to ready for a new measurement within the same test.

Note: By pressing the Back button, the user **does not store** the measurement and the instrument is back to ready for a measurement within the same test.

6.3.5.2 *Recording multispectrum mode (average spectrum or reverberation time spectrum)*

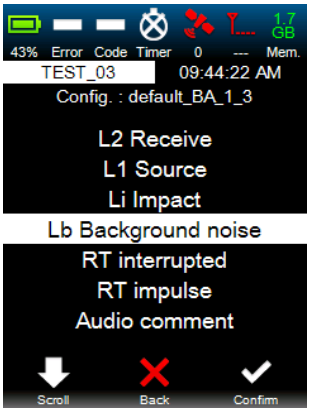
01 - Instantaneous 1sec LeqT spectrum in blue
02 - Max hold spectrum in red
03 - Min hold spectrum in green
04 - LXYT instantaneous value
05 - Countdown



Once the L1, L2, Li, T, Lb button pressed, the instrument starts the measurement and displays

By pressing the End button, the instrument displays a table of measurement types with the recognized type preselected:

6.3.6 *Automatic measurement type recognition confirmation*



The recognized measurement type is confirmed by pressing the Confirm button. The instrument displays the result (refer to § 6.3.7 Measurement result).

Note: By pressing the Back button, the user **does not store** the measurement and the instrument is back to ready for a measurement within the same test.

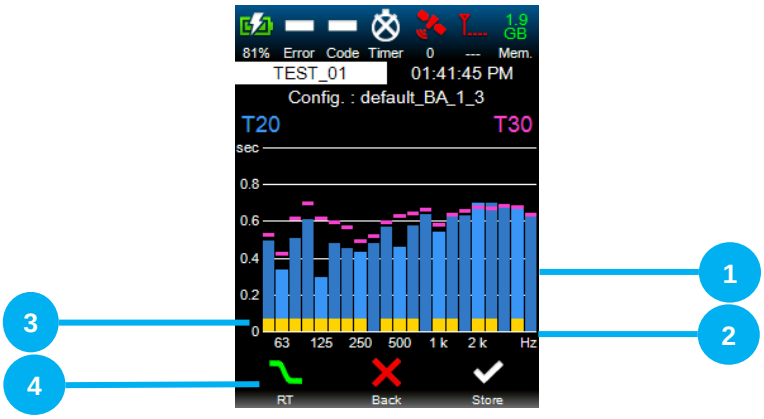
6.3.7 *Measurement result*

6.3.7.1 Reverberation time spectrum

The reverberation time spectrum is calculated if the excitation is either impulsive or interrupted (refer to § Chapter 7 Automatic measurement type recognition for more information.

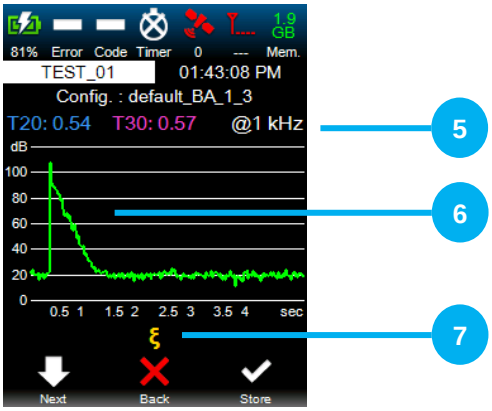
After a reverberation time measurement, the screen below is displayed showing the user all relevant information:

01 - In pink, the reverberation time T30
02 - In blue, the reverberation time T20
03 - In yellow, if at least one ISO 3382 indicator is not met
04 - Access to decay information

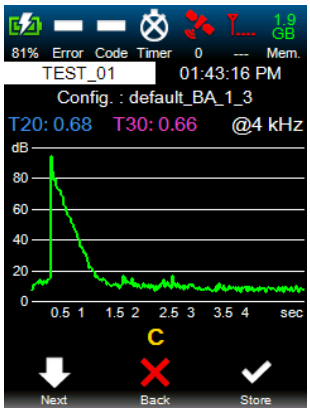


Pressing the decay button displays the decay data for each frequency band measured, with non-compliance indicator(s) including ISO 3382:

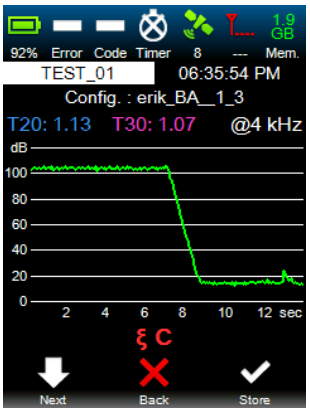
05 - Frequency band considered
06 - Decay curve
07 - ISO 3382 non-compliance indicator(s)



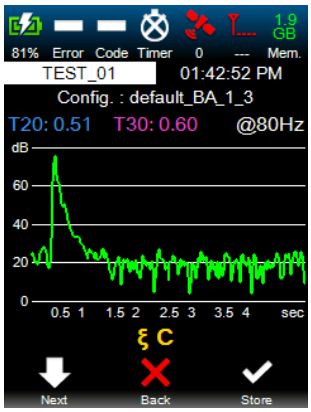
Various examples of decay curves :



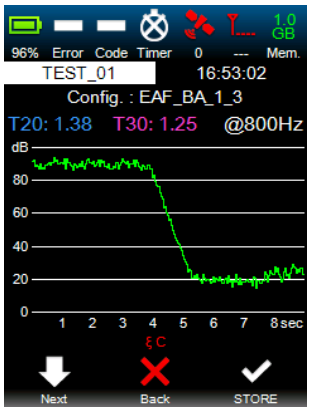
Tr impulse
T20<T30



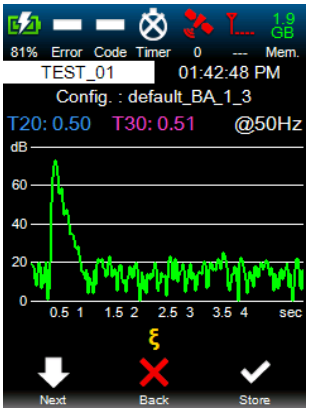
Tr interrupted
T20<T30
ξ >1%



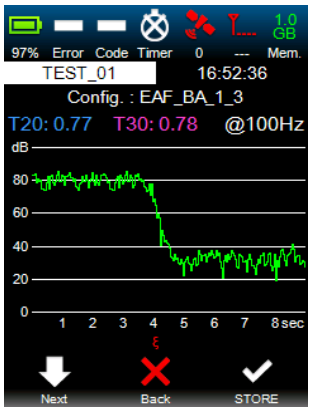
Tr impulse
T30>>T20
ξ >1%



Tr interrupted
T20<T30



Tr impulse
ξ >1%



Tr interrupted
ξ >1%

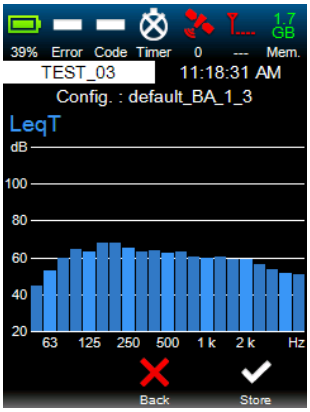
Note: the indicators are calculated on individual decays, therefore the sensitivity to non-compliance is higher than on average decays. They are to be used with precaution and it is up to the user to accept or not the validity of the measurement.

The ISO 3382 non-compliance indicators are as follow:

Name	Quality indicator	Description, default values
N	Background noise level too high*	Low dynamic range (T20 between 31-35 dB)
D	Calculation impossible*	Insufficient dynamic (< 41 dB for T30; < 31 dB for T20)
<	Reverberation time too low*	Tr < 0.24 seconds (scaled by logging period = 20 ms)
ξ	Non-linearity*	Non-linearity parameter ξ >1%
C	Curvature*	C > 10% or C < 0
L	Linearity of the sound source	Difference between adjacent 1/1 or 1/3 octave bands > 6 dB

*: ISO 3382-2 standard indicator

6.3.7.2 *Averaged spectrum result*

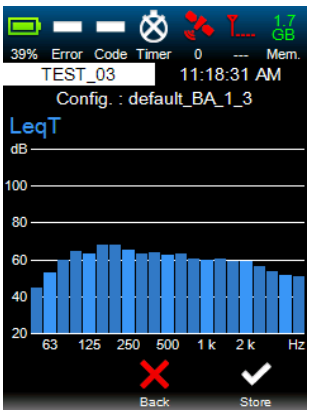


On automatic recognition confirmation the following result is displayed:

- Averaged receive spectrum; calculated while event 1 is ongoing
- Averaged source spectrum; calculated while event 4 is ongoing
- Averaged impact noise spectrum; calculated while event 3 is ongoing
- Averaged background noise spectrum; no event detected, calculated on the whole measurement duration

Note: if the user has manually modified the predefined recognized measurement type, the average spectrum is calculated on the whole logging period.

6.3.8 *Measurement store*

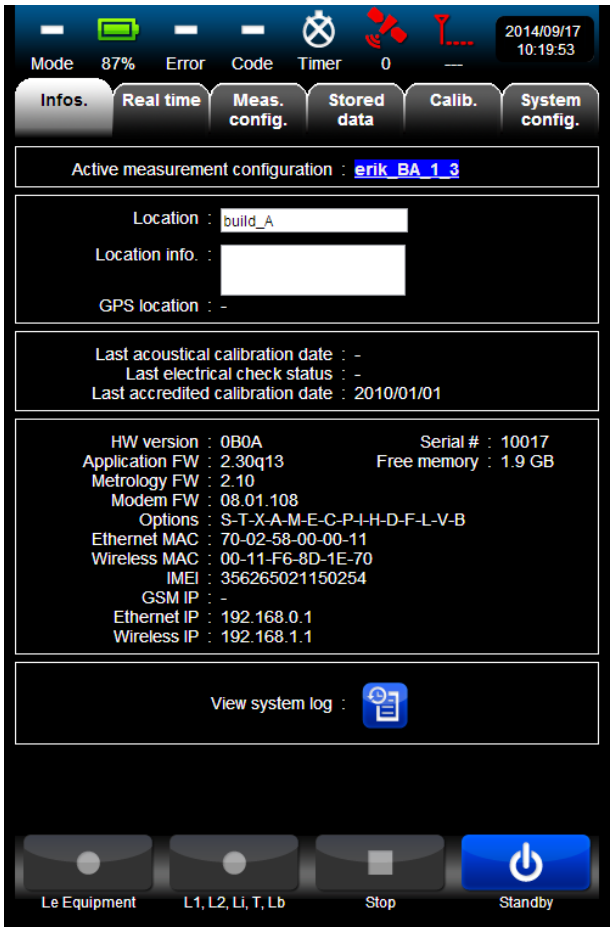


By pressing the button back , the instrument does not store the measurement and is back to “ready for measurement” mode

By pressing the button Store , the instrument stores the measurement and is back to “ready for measurement” mode.

6.4 WEB INTERFACE (ACTIVE WHEN NOT IN "READY FOR MEASUREMENTS" MODE)

The **FUSION** and **DUO** sound level meters include an embedded Wi-Fi module that can be used to operate remotely via a dedicated web interface. Using a smartphone, tablet or computer, when not in "ready for measurements" mode activated (refer to § 6.3.5) from the integrated interface, the user can access all information, configurations, calibration and data:

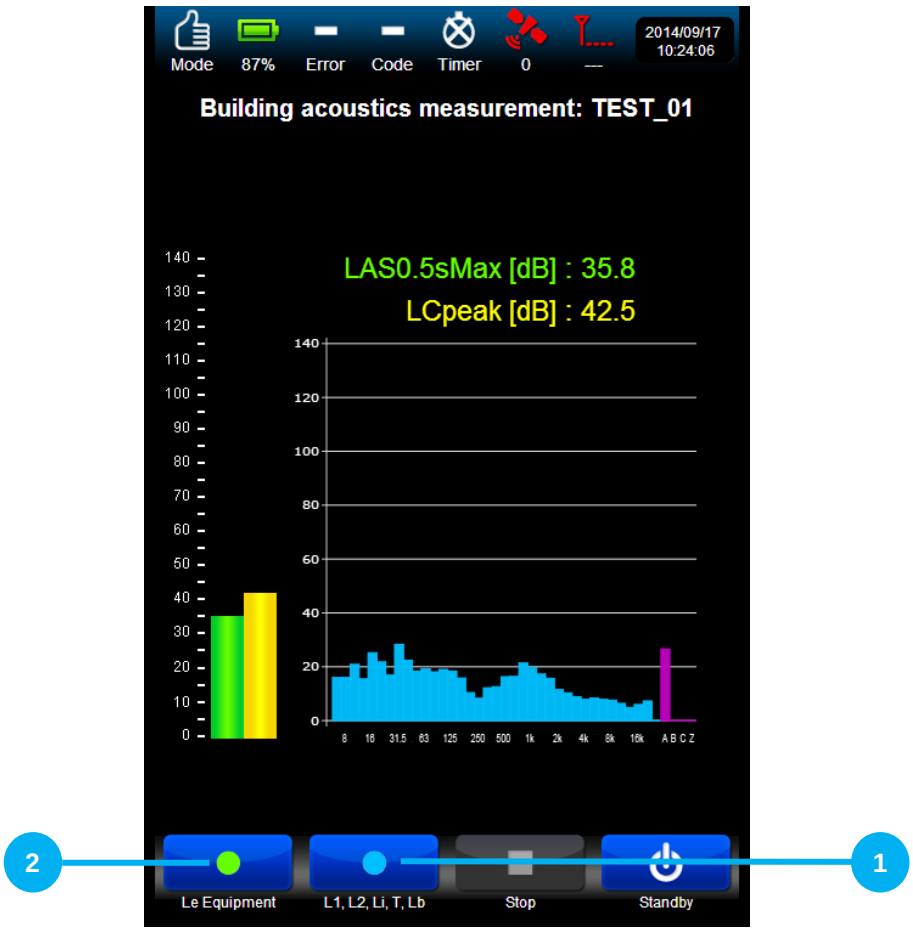


6.5 REMOTE CONTROL OF FUSION AND DUO (ACTIVE WHEN IN "READY FOR MEASUREMENTS" MODE)

When in "ready for measurements" mode activated (refer to § 6.3.5) from the integrated interface, the user can use the web interface as a remote control for start, view and stop current measurements:

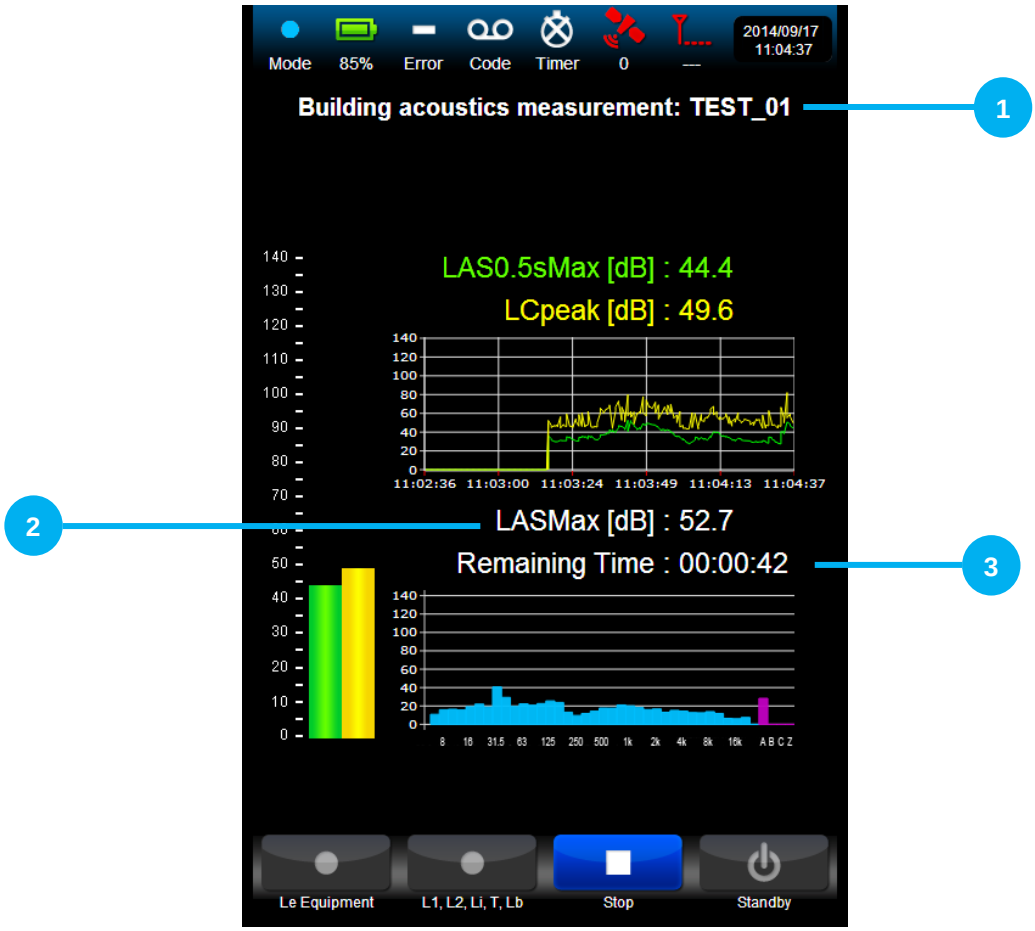
6.5.1 *Remote control to start a measurement*

01 – Start a multispectrum measurement
02 – Start an equipment noise measurement



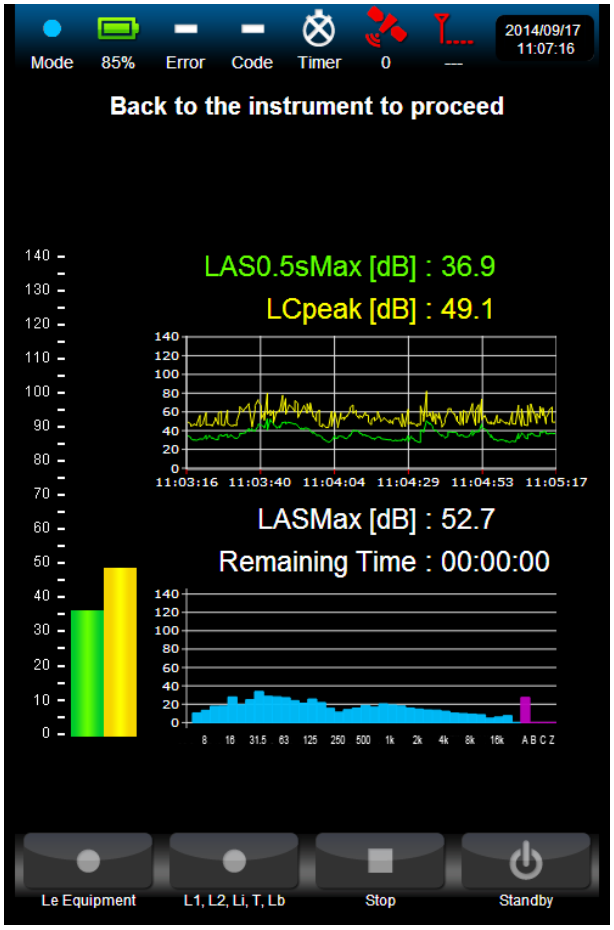
6.5.2 *Remote control when a multispectrum or equipment noise measurement is in progress*

01 – reminder of the ongoing test
02 – LXYMax of the ongoing measurement
03 – countdown



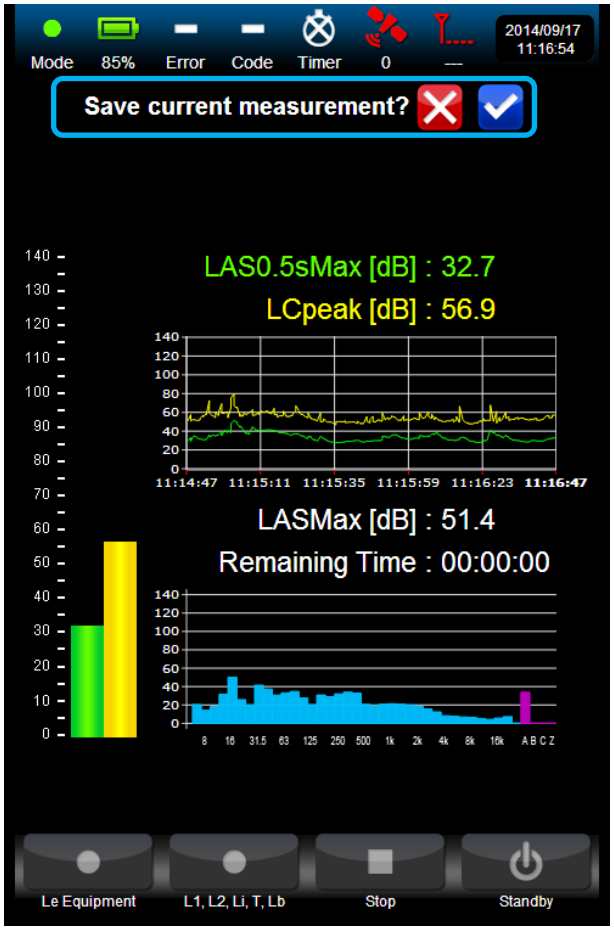
6.5.3 *Remote control when a multispectrum is stopped*

The user has to go back to the instrument to confirm or modify the detected automatic recognition.



6.5.4 *Remote control when an equipment noise measurement is stopped*

In that case, the user can save or discard the equipment noise measurement directly from the remote control:



After saving/discarding the measurement, a new measurement can be processed by the remote interface. Advantage: if the operator operates the measurement from another room, it is not necessary for him to go back to the instrument.

Chapter 7
AUTOMATIC MEASUREMENT TYPE RECOGNITION

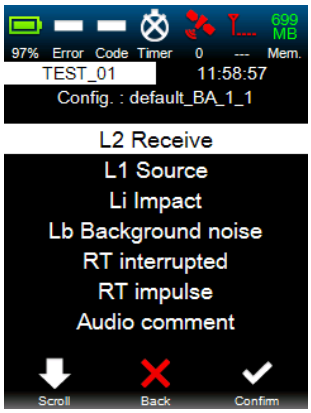
7.1 NO NEED TO PROGRAM WHAT YOU ARE MEASURING...

Of course, with a measurement campaign organized in this way, **dBInside** software needs to know the type of each measurement: Source, receive, reverberation time, impact or equipment. Defining these types is often complex in the instrument interface and a waste of time on site.

01dB Smart Building Acoustics Solution eliminates this step to improve your productivity.

Simply perform a measurement and then, when it is complete, your sound level meter automatically detects the type of measurement:

- L1 Source level
- L2 Receive level
- Li Impact noise level
- Lb Background noise
- T Reverberation time with interrupted source
- T Reverberation time with impulsive source



Confirm and proceed with the next measurement.

7.2 01DB SMART RECOGNITION*

To achieve this, **01dB** brings to bear its extensive experience in the automatic recognition of noise sources and in advanced recognition techniques implemented in its latest-generation of sound level meters. This innovation, which tests several conditions, correctly recognizes over 90% of signals measured.

If the recognition is not correct, simply use the left button to select the type of measurement carried out.

01dB includes this productivity-enhancing innovation as a standard feature in the building acoustics module for **FUSION** and **DUO**.

***Note:** **01dB** has a patent pending to protect this technological innovation.

7.3 DESCRIPTION OF THE PRINCIPLE

7.3.1 *Recognition of the measurements in the source room (L1 or reverberation time measurement)*

The sound pressure level L1 in the source room is deducted from ISO 3743-2:

Lw = L1 - 10*log (T/To) + 10*log (V/Vo) – 13 dB [eq. 0]

In this standard,
Lw: sound power level of the sound source
To = 1 sec; Vo = 1 m3
T: reverberation time of the room
V: volume of the room

Then,

L1 = Lw + 10*logT – 10*logV + 13 dB [eq.1]

From eq. 1, depending on the extrema of V and T,we can deduct:

For example classical values in buildings:

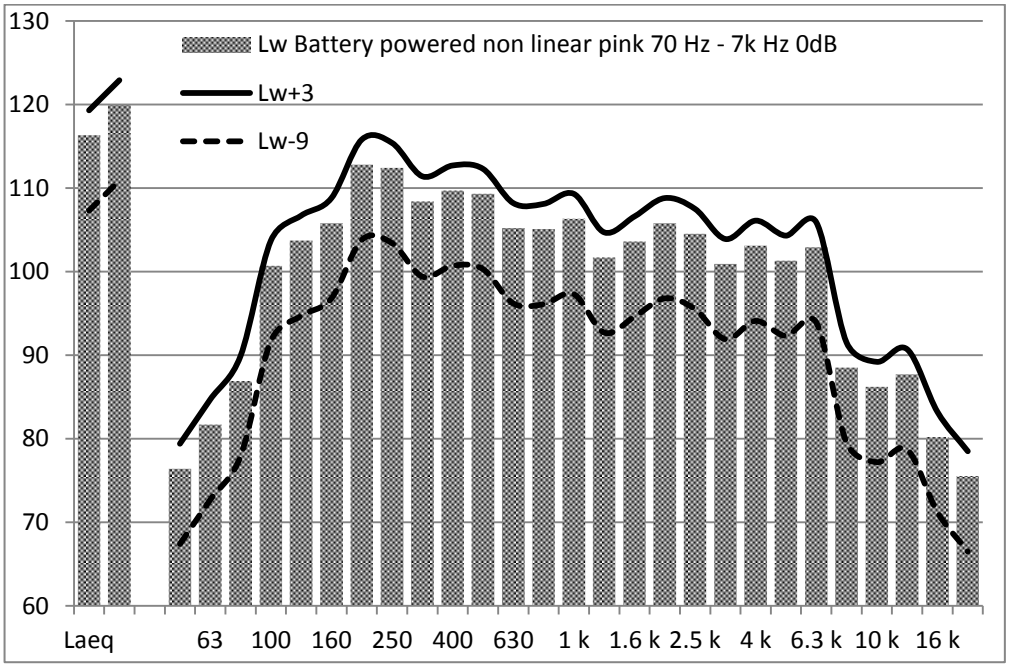
- 25<V<75 m3 → 19<10*logV<19
- 0.5<T<2.5 sec → -3<10*logT<4

Lw – 9< L1 <Lw + 3 dB [eq. 2]

Knowing the sound power level of the sound source for each 1/N oct. band, it is therefore possible to detect the minimum sound pressure level obtained in the source room for L1 measurements:

L1>Lw-9 dB [eq3]

When used with Omni source 01dB LS01, it is necessary to select a trigger value within the black curves:



To distinguish L1 measurement from interrupted reverberation time measurement, the instrument detects whether the source is on during all the acquisition period or has been switched off during the measurement.

7.3.2 *Recognition of L2 measurements (receiving room)*

The sound pressure level in the receiving room L2 is deducted from:

L2 = L1 – DnT + 10log(T/0.5) dB [eq. 4]

Where DnT is the sound insulation value per 1/N oct of the device under test.

Considering usual performance of buildings:
- lowest performance device (DnTMin)
- highest performance device (DnTMax)
- 0.5<T<2.5 sec → -3<10*logT<4

Lw-DnTMax – 12 < L2 < Lw – DnTMin +10 dB [eq. 5]

7.3.3 *Recognition of Li impact noise in the receiving room*

The impact sound pressure level Li in the receiving room is deducted from:

Li = LnT + 10*log(T/0.5) dB [eq. 6]

Considering usual performance of buildings:
- lowest performance device (LnTMax)
- highest performance device (LnTMin)
- 0.5<T<2.5 sec → -3<10*logT<4

LnTMin - 7 < Li < LnTMax dB [eq. 7]

Due to possible interaction between the detection of L2 and Li, it is recommended to make the selection of trigger on Li based on frequencies not excited by the sound source. We recommend to use trigger on the following frequencies:10 Hz (1/3 oct) or 8 Hz (1/1 oct)

7.3.4 *Recognition of impulsive reverberation time*

An impulsive reverberation time measurement is recognized on the LCPk criteria for the trigger that must be greater than the impulsive noise created by the sound source LCpkMax; from eq. 2 we can deduct:

LCpk for impulse RT > LCpkMax + 3 dB [eq. 8]

Considering the performance of the sound source (LCpkMax evaluated as Lw + 4)

If during a measurement:

LCpk > Lw + 7 dB [eq. 9]

Then the impulsiveness of the sound is recognized as a measurement for impulsive reverberation time.

7.3.5 *Recognition of background noise measurement*

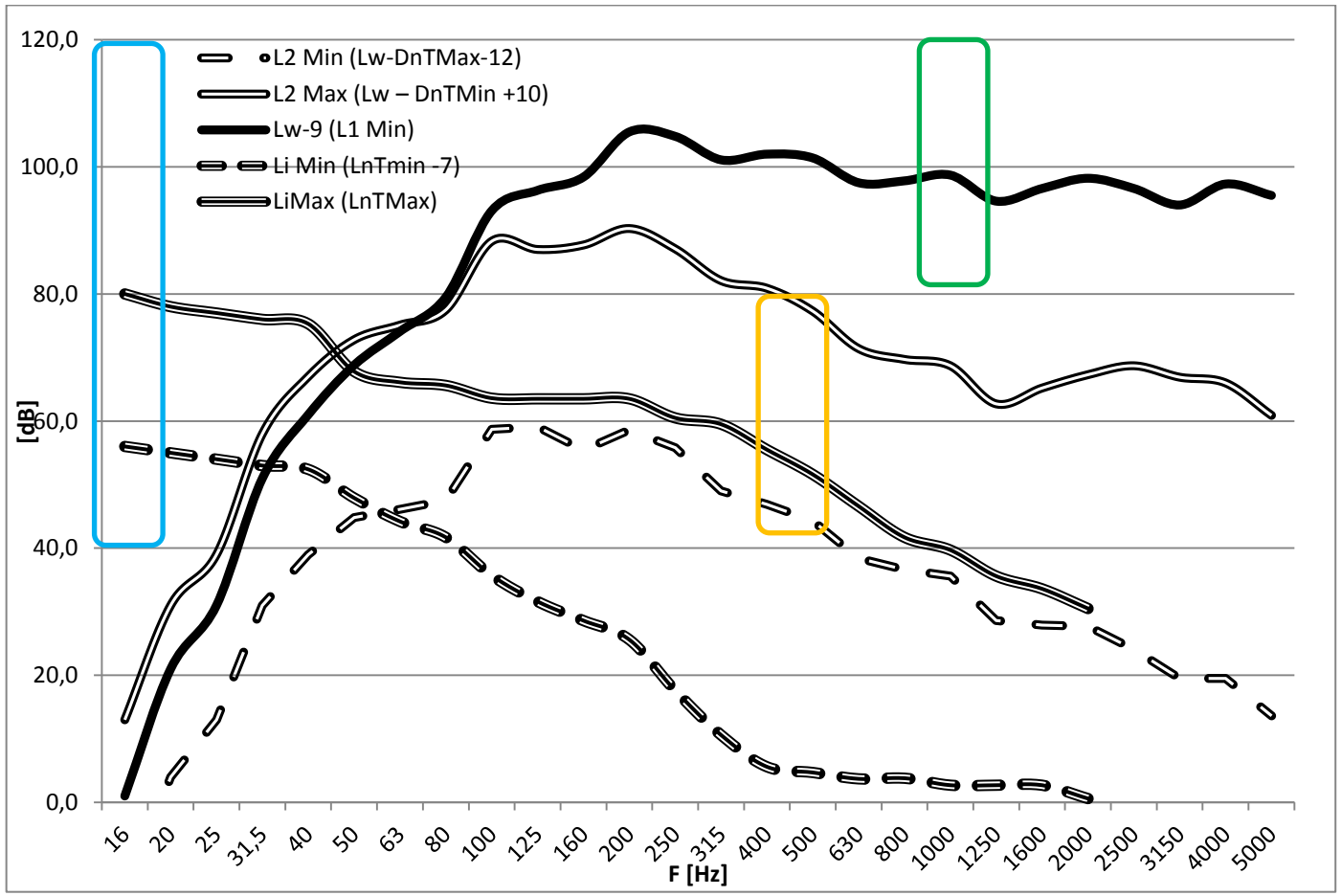
If none of the previous criteria is satisfied, the instrument proposes to classify the measurement as background noise.

7.3.6 *Example of extrema for the determination of the trigger levels*

Various simulations and measurements in dwellings have been collected and the table below gives the summary of the statistical values that have been used to establish the trigger levels for automatic recognition:

F	L2 Min (Lw-DnTMax-12)	L2 Max (Lw – DnTMin +10)	Lw-9 (L1 Min)	Li Min (LnTmin -3)	LiMax (LnTMax+7)	Li Min (LnTmin -7)	LiMax (LnTMax)
16	-15	13	1	56	80	60	84
20	4	31	21	55	78	58	83
25	13	39	31	54	77	57	82
31,5	31	58	51	53	76	57	81
40	39	67	61	56	80	56	80
50	45	73	69	55	78	55	78
63	46	75	74	54	77	54	77
80	48	78	80	53	76	53	76
100	59	88	93	52	75	52	75
125	59	87	96	48	68	48	68
160	55	88	98	44	66	44	66
200	59	90	106	42	66	42	66
250	56	87	105	36	64	36	64
315	49	82	101	32	64	32	64
400	47	81	102	29	64	29	64
500	44	77	101	26	64	26	64
630	38	71	98	18	61	18	61
800	37	70	98	11	60	11	60
1000	36	69	99	6	56	6	56
1250	29	63	95	5	52	5	52
1600	28	65	97	4	47	4	47
2000	28	67	98	4	42	4	42
2500	24	69	97	3	40	3	40
3150	20	67	94	3	36	3	36
4000	20	66	97	3	34	3	34
5000	14	61	96	1	31	1	31

7.3.7 *Graphical summary*



7.3.8 *Default detection parameters*

Based on the statistical analysis exposed above, the following parameters have been implemented in the default measurement setups

Event	Above @ 1/3oct default_BA_1_3	Above at 1/1 oct Default_BA_1_1
1	40 dB@500 Hz	45 dB@500 Hz
2	40 dB@500 Hz and pre+post-trigger	45 dB@500 Hz and pre+post-trigger
3	50 dB@10 Hz	50 dB@8 Hz
4	85 dB@1 kHz	90 dB@1 kHz
5	128 dB@LCPk	128 dB@LCPk

7.3.9 *Priority for recognition of the type of measurement*

A detection priority is programmed in order to improve the recognition process:

Priority	Detected event	Measurement type
1	5	RT impulse
2	1+2+4	L1
3	1+2+4 then none	RT interrupted
4	3	Li
5	1+2	L2
6	None	Background noise

7.3.10 *Setup your own recognition parameters*

Based on your own equipment and on the type of elements you usually characterize, the following parameters could be fine-tuned

Event	Fine tuning
1	Not recommended to change
2	Not recommended to change
3	Can be increased up to 65 dB with lower performance of the devices under test
4	Apply the Lw@1 kHz- 9 dB of your sound source characteristic
5	Apply Lw (Z) + 7 of your sound source characteristic

Chapter 8
dBInside post processing software

8.1 General presentation

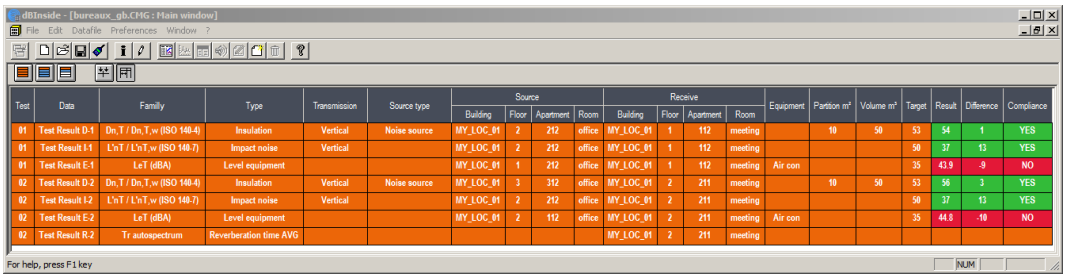
8.1.1 *Introduction*

dBInside program has an interface designed to enhance acoustics consultants' efficiency and productivity. The purpose is to reduce the time spent on:

- data entry related to the measurements (measurement location and details, etc.),
- calculation of standardized indicators (unique indices)
- generation of measurement reports.

The main interface is organized as a table of information on tests results and measurements, including:

- Measurement type
- Transmission type (vertical, horizontal, diagonal, facade)
- Source measurement location
- Reception measurement location, etc.

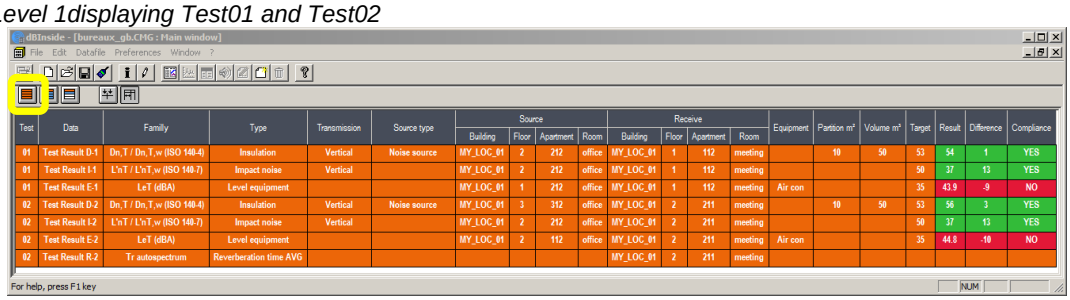

dBInside - [bureaux_gb.CMG : Main window]
File Edit Datafile Preferences Window ?
Test Data Familly Type Transmission Source type Source Receive Equipment Partition m² Volume m³ Target Result Difference Compliance
Building Floor Apartment Room Building Floor Apartment Room
01 Test Result D-1 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 10 50 53 54 1 YES
01 Test Result I-1 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 50 37 13 YES
01 Test Result E-1 LeT (dBA) Level equipment MY_LOC_01 1 212 office MY_LOC_01 1 112 meeting Air con 35 43.9 -9 NO
02 Test Result D-2 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 3 312 office MY_LOC_01 2 211 meeting 10 50 53 56 3 YES
02 Test Result I-2 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 2 211 meeting 50 37 13 YES
02 Test Result E-2 LeT (dBA) Level equipment MY_LOC_01 2 112 office MY_LOC_01 2 211 meeting Air con 35 44.8 -10 NO
02 Test Result R-2 Tr autospectrum Reverberation time AVG MY_LOC_01 2 211 meeting
For help, press F1 key
NUM

This interface comprises three levels which may be expanded simply by clicking on an icon. These three levels correspond to:

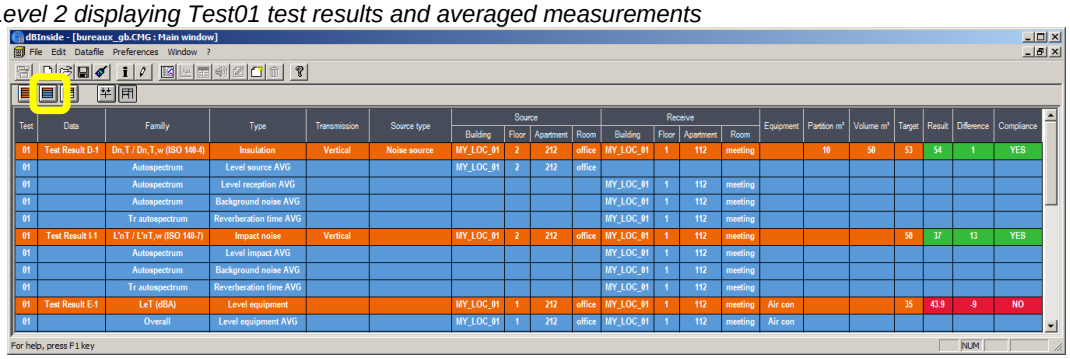
- Level 1: concatenated: Standardized test results
- Level 2: more information: add of averaged measurements
- Level 3: all information: add of all stored measured data

An example of the three levels is shown below:

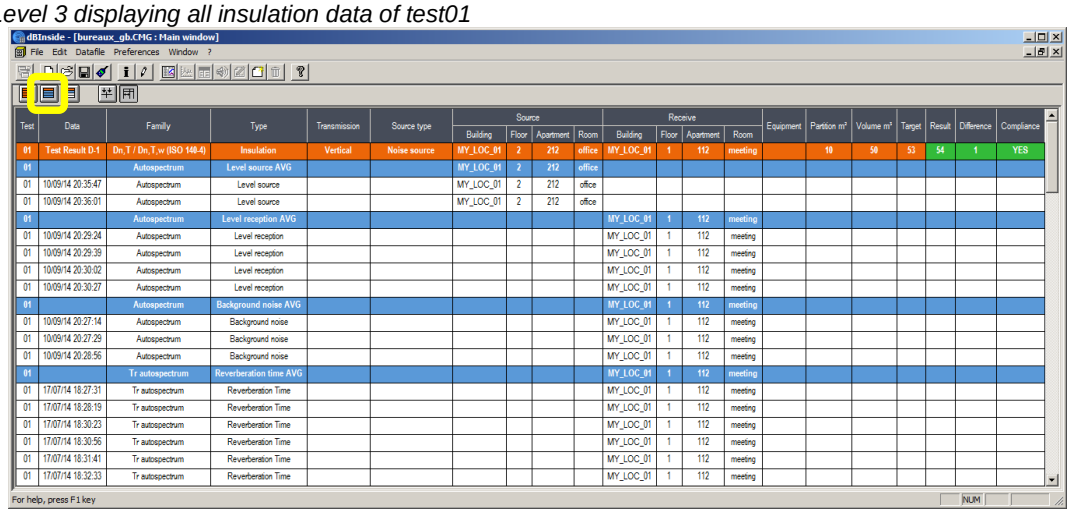
Level 1displaying Test01 and Test02


dBInside - [bureaux_gb.CMG : Main window]
File Edit Datafile Preferences Window ?
Test Data Familly Type Transmission Source type Source Receive Equipment Partition m² Volume m³ Target Result Difference Compliance
Building Floor Apartment Room Building Floor Apartment Room
01 Test Result D-1 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 10 50 53 54 1 YES
01 Test Result I-1 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 50 37 13 YES
01 Test Result E-1 LeT (dBA) Level equipment MY_LOC_01 1 212 office MY_LOC_01 1 112 meeting Air con 35 43.9 -9 NO
02 Test Result D-2 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 3 312 office MY_LOC_01 2 211 meeting 10 50 53 56 3 YES
02 Test Result I-2 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 2 211 meeting 50 37 13 YES
02 Test Result E-2 LeT (dBA) Level equipment MY_LOC_01 2 112 office MY_LOC_01 2 211 meeting Air con 35 44.8 -10 NO
02 Test Result R-2 Tr autospectrum Reverberation time AVG MY_LOC_01 2 211 meeting
For help, press F1 key
NUM

Level 2 displaying Test01 test results and averaged measurements



Level 3 displaying all insulation data of test01



8.1.2 *Smart organization*

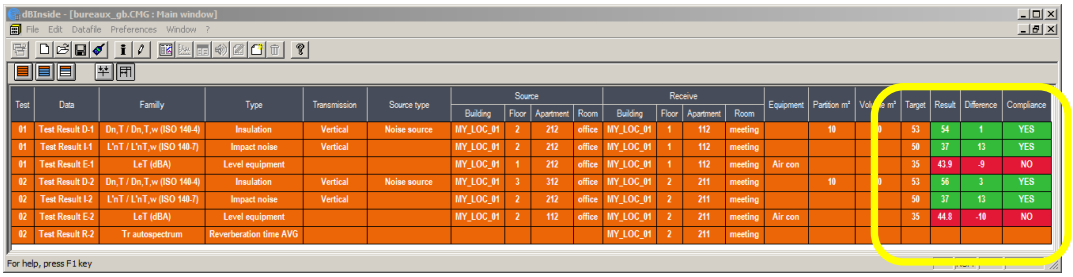
The measurements organization in **FUSION** and **DUO** is effective when used with **dBInside** program. If the user opts for common receiving room import function, the" test results (insulation, impact and equipment) will be organized with a single receiving room, in a single test container (cmg file).

dBInside program will automatically understand that the container contains three separate tests and will accordingly assign the measurements to three test types, but using the same background noise level and the same reverberation time for each.

This feature makes it possible to quicker process measurements by avoiding unnecessary operations.

8.1.3 *Optimization of calculation time*

This organization enables **dBInside** program to automatically calculate standardized ratings as a function of the selected standard, once the measurements are transferred. These indicators will be displayed in the test result line.



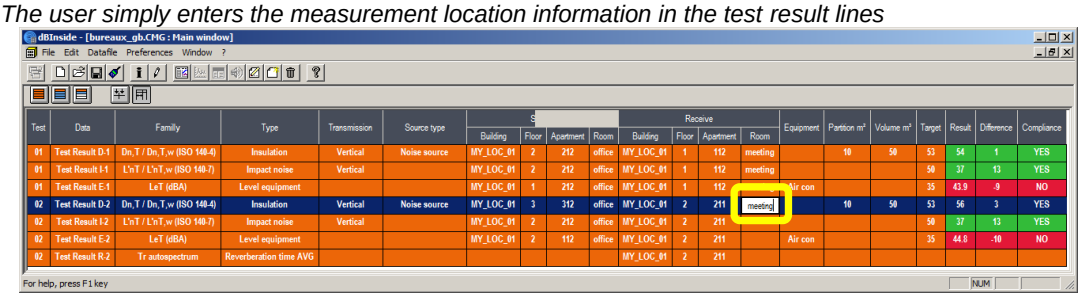
The indicator will automatically be recalculated if any change is made to the test, such as recalculating a new average measurement result and test results accordingly if one or several measurements are deleted.

The user can also enter a target value in accordance with the local country regulations. **dBInside** program automatically shows the difference between the result and the target value. A change of color (green if compliance is fulfilled and red if not) provides a visual indication for quick identification.

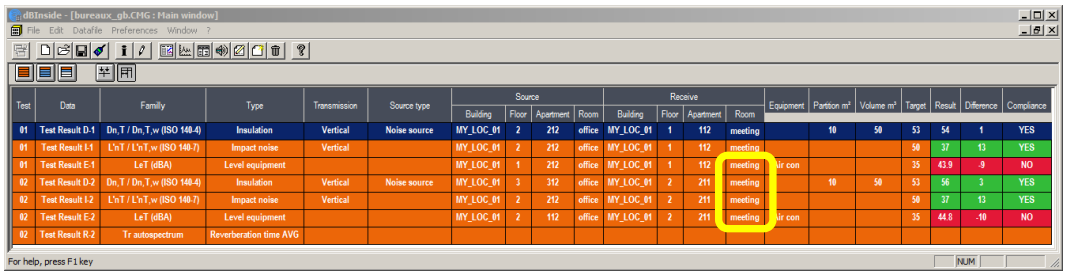
8.1.4 *Smart data entry*

On-site entry of location information for all measurements is a tedious and laborious operation. However, this information is essential in order to produce test reports. With **01dB**, this data is entered in **dBInside** program via a smart method.

The user simply enters the measurement location information in the test result lines


dBInside - [bureaux_gb.CMG : Main window]
File Edit Datafile Preferences Window ?
Test Data Family Type Transmission Source type Source Receive Equipment Partition m² Volume m³ Target Result Difference Compliance
Building Floor Apartment Room Building Floor Apartment Room
01 Test Result D-1 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 10 50 53 54 1 YES
01 Test Result I-1 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 50 37 13 YES
01 Test Result E-1 LeT (dBA) Level equipment MY_LOC_01 1 212 office MY_LOC_01 1 112 Air con 35 43.9 -9 NO
02 Test Result D-2 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 3 312 office MY_LOC_01 2 211 meeting 10 50 53 56 3 YES
02 Test Result I-2 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 2 211 50 37 13 YES
02 Test Result E-2 LeT (dBA) Level equipment MY_LOC_01 2 112 office MY_LOC_01 2 211 Air con 35 44.8 -10 NO
02 Test Result R-2 Tr autospectrum Reverberation time AVG MY_LOC_01 2 211
For help, press F1 key
NUM

When the cell is filled in, the program automatically copies the information entered into the averageresults and into each measurement. This quickly produces the following table, for example:

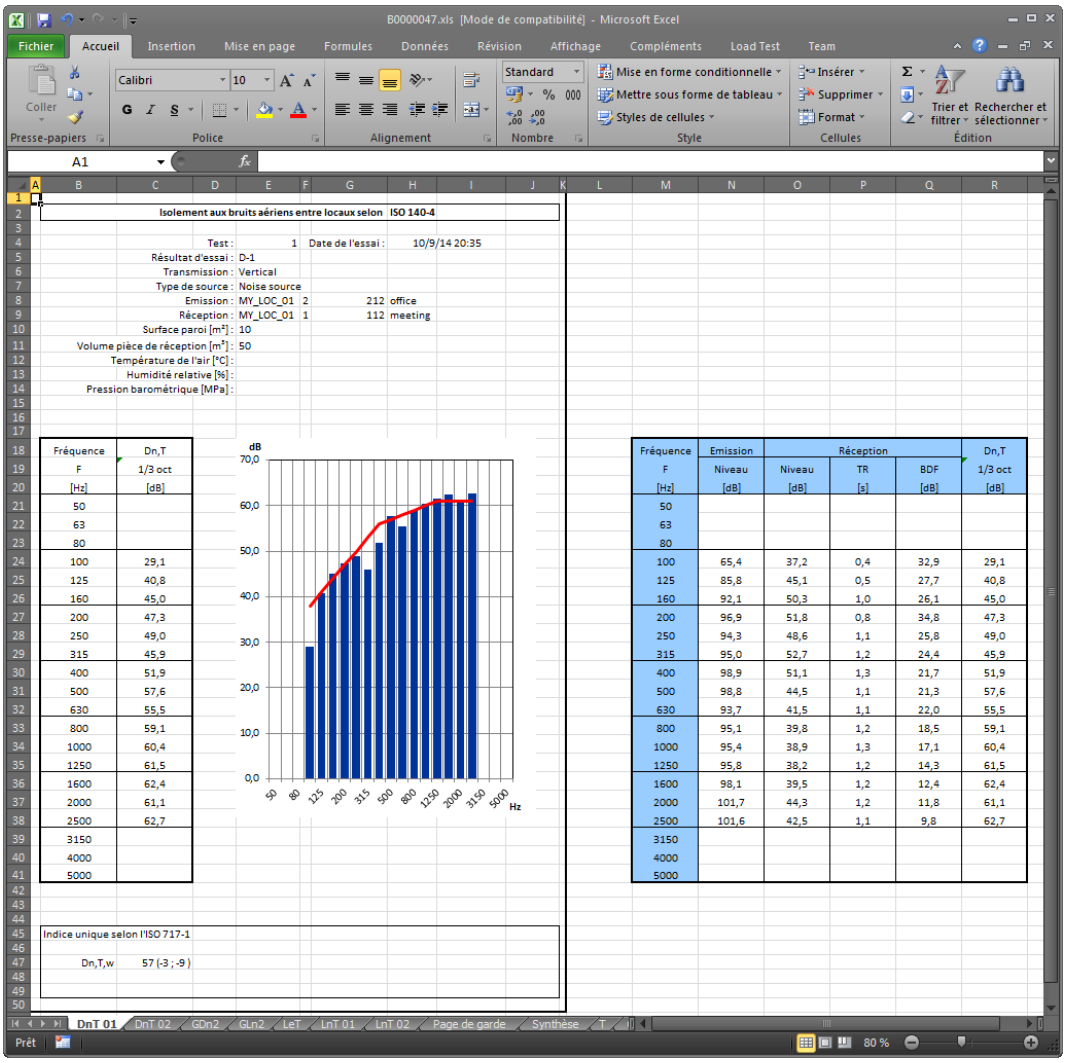

dBInside - [bureaux_gb.CMG : Main window]
File Edit Datafile Preferences Window ?
Test Data Family Type Transmission Source type Source Receive Equipment Partition m² Volume m³ Target Result Difference Compliance
Building Floor Apartment Room Building Floor Apartment Room
01 Test Result D-1 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 10 50 53 54 1 YES
01 Test Result I-1 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 50 37 13 YES
01 Test Result E-1 LeT (dBA) Level equipment MY_LOC_01 1 212 office MY_LOC_01 1 112 meeting Air con 35 43.9 -9 NO
02 Test Result D-2 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 3 312 office MY_LOC_01 2 211 meeting 10 50 53 56 3 YES
02 Test Result I-2 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 2 211 meeting 50 37 13 YES
02 Test Result E-2 LeT (dBA) Level equipment MY_LOC_01 2 112 office MY_LOC_01 2 211 meeting Air con 35 44.8 -10 NO
02 Test Result R-2 Tr autospectrum Reverberation time AVG
For help, press F1 key
NUM

All the cells have been completed automatically by **dBInside** based on the orange cells.

8.1.5 *Reporting*

Once all results have been validated by the user, standardized reports can be produced.

The test reports are generated in Microsoft® EXCEL using a template based on the ISO 140 standard.

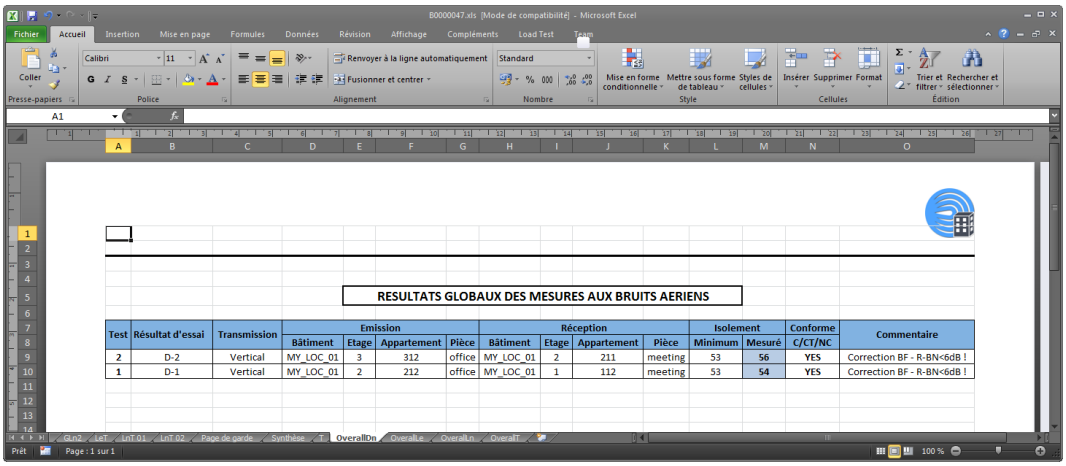

B0000047.xls [Mode de compatibilité] - Microsoft Excel
Isolement aux bruits aériens entre locaux selon ISO 140-4
Test : 1 Date de l'essai : 10/9/14 20:35
Résultat d'essai : D-1
Transmission : Vertical
Type de source : Noise source
Emission : MY_LOC_01 2 212 office
Réception : MY_LOC_01 1 112 meeting
Surface paroi [m²] : 10
Volume pièce de réception [m³] : 50
Température de l'air [°C] :
Humidité relative [%] :
Pression barométrique [MPa] :
Indice unique selon l'ISO 717-1
Dn,T,w 57 (-3 ; -9)
dB
Hz
DnT 01
DnT 02
GDn2
GLn2
LeT
LnT 01
LnT 02
Page de garde
Synthèse

Fréquence F [Hz]	Dn,T 1/3 oct [dB]
50	
63	
80	
100	29,1
125	40,8
160	45,0
200	47,3
250	49,0
315	45,9
400	51,9
500	57,6
630	55,5
800	59,1
1000	60,4
1250	61,5
1600	62,4
2000	61,1
2500	62,7
3150	
4000	
5000	

Fréquence F [Hz]	Emission Niveau [dB]	Réception Niveau [dB]	Réception TR [s]	Réception BDF [dB]	Dn,T 1/3 oct [dB]
50					
63					
80					
100	65,4	37,2	0,4	32,9	29,1
125	85,8	45,1	0,5	27,7	40,8
160	92,1	50,3	1,0	26,1	45,0
200	96,9	51,8	0,8	34,8	47,3
250	94,3	48,6	1,1	25,8	49,0
315	95,0	52,7	1,2	24,4	45,9
400	98,9	51,1	1,3	21,7	51,9
500	98,8	44,5	1,1	21,3	57,6
630	93,7	41,5	1,1	22,0	55,5
800	95,1	39,8	1,2	18,5	59,1
1000	95,4	38,9	1,3	17,1	60,4
1250	95,8	38,2	1,2	14,3	61,5
1600	98,1	39,5	1,2	12,4	62,4
2000	101,7	44,3	1,2	11,8	61,1
2500	101,6	42,5	1,1	9,8	62,7
3150					
4000					
5000					

These reports can be customized by the user.

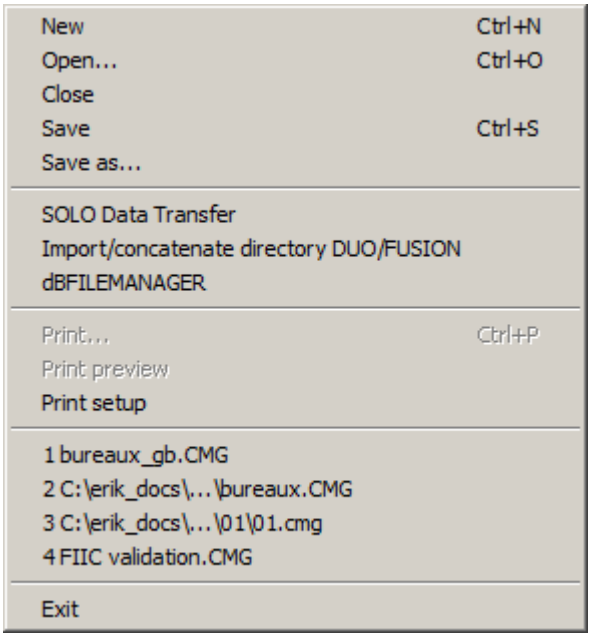
In addition to the test report, the user can also access a summary table showing a simple view of all test results.



Test	Résultat d'essai	Transmission	Emission Bâtiment	Emission Etage	Emission Appartement	Emission Pièce	Réception Bâtiment	Réception Etage	Réception Appartement	Réception Pièce	Isolement Minimum	Isolement Mesuré	Conforme C/CT/NC	Commentaire
2	D-2	Vertical	MY_LOC_01	3	312	office	MY_LOC_01	2	211	meeting	53	56	YES	Correction BF - R-BN<6dB !
1	D-1	Vertical	MY_LOC_01	2	212	office	MY_LOC_01	1	112	meeting	53	54	YES	Correction BF - R-BN<6dB !

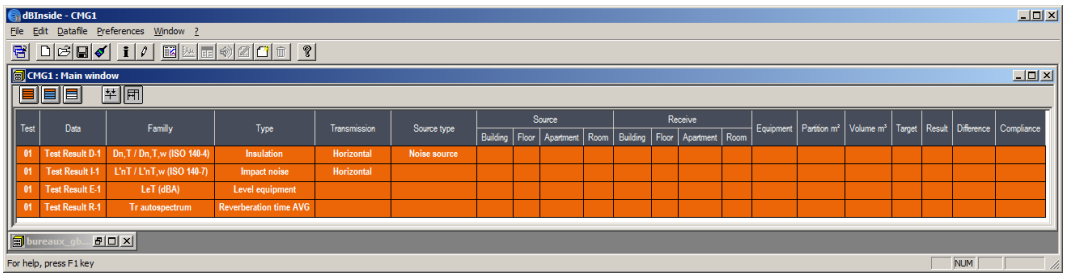
8.2 MENUS

8.2.1 *File*



8.2.1.1 New

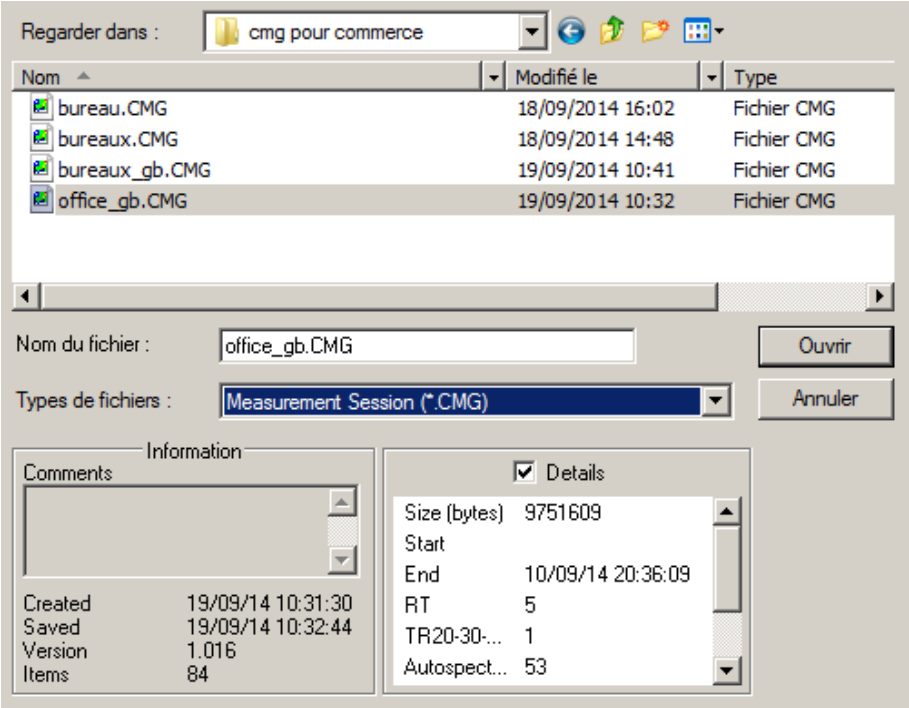
To create a new measurement session datafile CMG that is empty, click on the icon or use the command File / New (CTRL+N). An empty table of information is then created:


dBInside - CMG1
File Edit Datafile Preferences Window ?
CMG1 : Main window
Test Data Family Type Transmission Source type Source Receive Equipment Partition m² Volume m³ Target Result Difference Compliance
Building Floor Apartment Room Building Floor Apartment Room
01 Test Result D-1 Dn,T / Dn,T,w (ISO 140-4) Insulation Horizontal Noise source
01 Test Result I-1 L'nT / L'nT,w (ISO 140-7) Impact noise Horizontal
01 Test Result E-1 LeT (dBA) Level equipment
01 Test Result R-1 Tr autospectrum Reverberation time AVG
bureaux_gb...
For help, press F1 key
NUM

8.2.1.2 Open...

To open a CMG measurement session file stored on the computer hard disk, click on the icon or use the command File / Open.

Note: this command is to be used exclusively on a dataset from dBInside.



The upper part of this dialog box allows the user to select a measurement session file CMG for processing in **dBInside** by choosing the appropriate location on the hard disk.
The lower part of this dialog box is activated when a CMG file has been selected in the list. Various information on the datafile are given such as:

- The date and time the file has been first recorded and when it was last saved, the version and the number of items contained in the CMG file.
- By ticking the details box, the size in bytes of the datafile, the start and end dates of the measurements, the number of events (audios, spectrums, etc.) as well as general parameters (dynamic range, number of codes, etc.)

Once a file has been selected, click on the **Open** button to open the datafile and proceed with its analysis.

8.2.1.3 Close

To close a measurement session file of type CMG, use the command File / Close. Closing down the window of the datafile will also result in closing the CMG datafile. All others windows (results' listings, plots, etc.) will be closed as well.

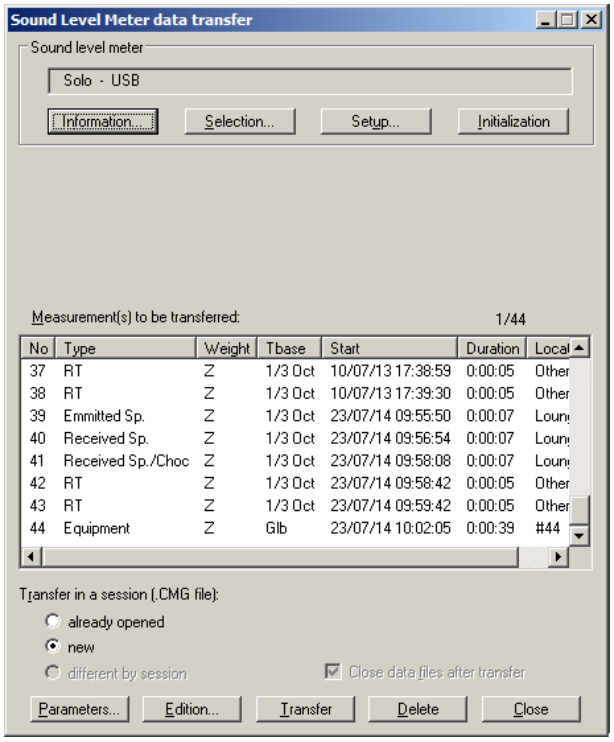
dBInside will also prompt the user to save this CMG datafile if any modifications have been made to it before closing.

8.2.1.4 Save/ Save as

Use the command File / Save (CTRL+S) or File / Save As or the icon to save the measurement session on the computer hard disk.

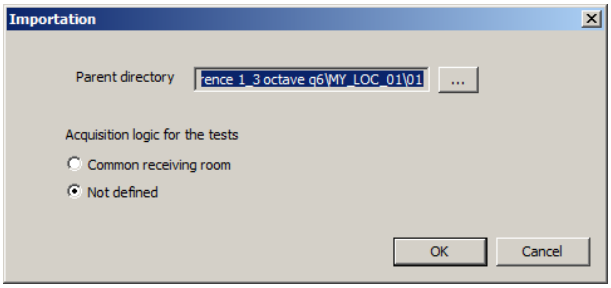
8.2.1.5 *SOLO data transfer*

When connecting a SOLO via the USB, on opening the window Sound Level Meter data transfer, the user can transfer the existing data by pressing the button “Transfer”. The data is then placed in a cmg file according to the Not Defined Mode (refer to § 8.2.1.6 Import/concatenate directory DUO/FUSION)


Sound Level Meter data transfer
Sound level meter
Solo - USB
Information...
Selection...
Setup...
Initialization
Measurement(s) to be transferred:
1/44
No Type Weight Tbase Start Duration Local
37 RT Z 1/3 Oct 10/07/13 17:38:59 0:00:05 Other
38 RT Z 1/3 Oct 10/07/13 17:39:30 0:00:05 Other
39 Emmitted Sp. Z 1/3 Oct 23/07/14 09:55:50 0:00:07 Loun
40 Received Sp. Z 1/3 Oct 23/07/14 09:56:54 0:00:07 Loun
41 Received Sp./Choc Z 1/3 Oct 23/07/14 09:58:08 0:00:07 Loun
42 RT Z 1/3 Oct 23/07/14 09:58:42 0:00:05 Other
43 RT Z 1/3 Oct 23/07/14 09:59:42 0:00:05 Other
44 Equipment Z Glb 23/07/14 10:02:05 0:00:39 #44
Transfer in a session (.CMG file):
already opened
new
different by session
Close data files after transfer
Parameters...
Edition...
Transfer
Delete
Close

8.2.1.6 *Import/concatenate directory DUO/FUSION*

Use exclusively this command to open the raw data stored by DUO or FUSION.
A new window appears:



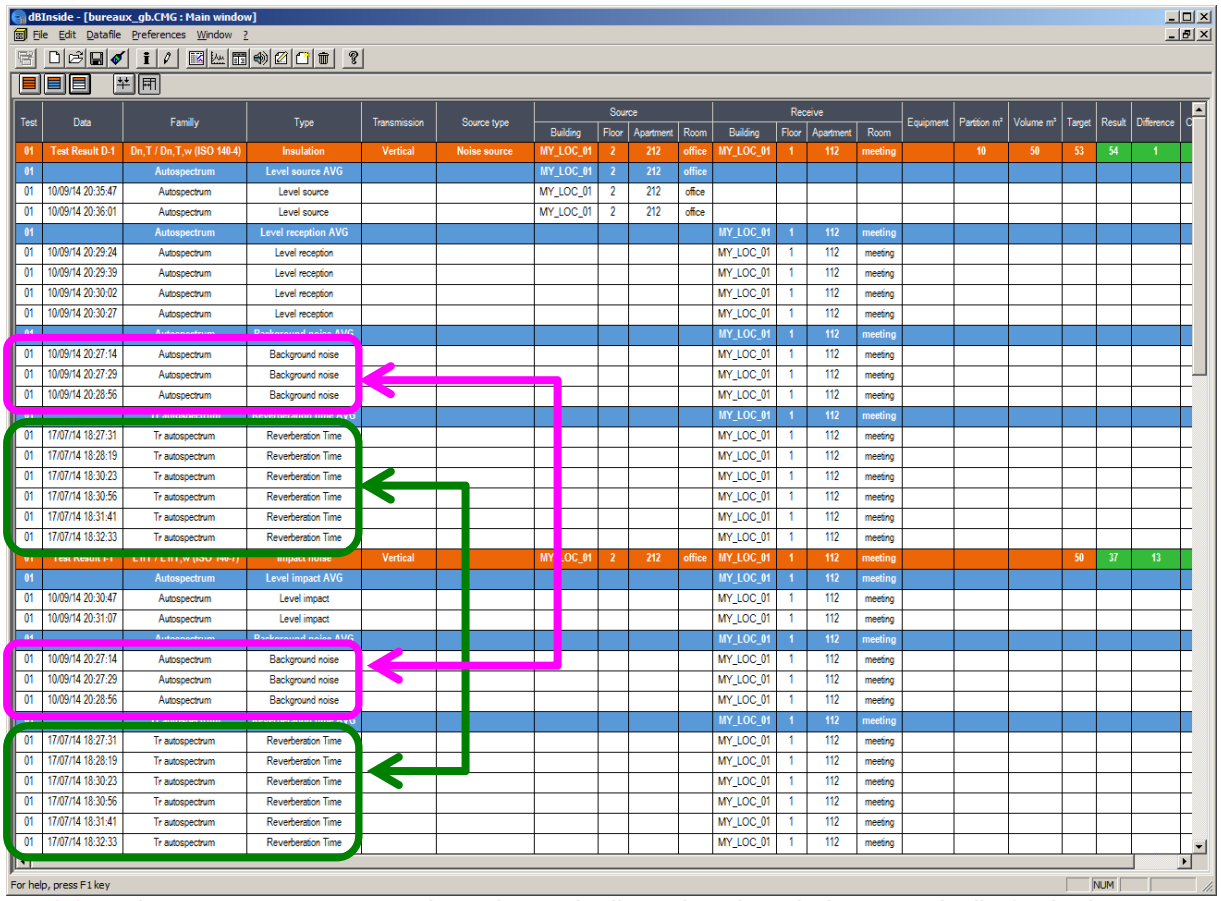
With the selection of the acquisition logic:

<u>Common receiving room</u>

In this mode all background noise and reverberation time measured data will be automatically duplicated and assigned to the test results:

- Test Result D-X Insulation,
- Test Result I-X Impact noise
- Test Result E-X: Level equipment

Where X corresponds to the number of the test where stand background noise and reverberation time data: TestX.



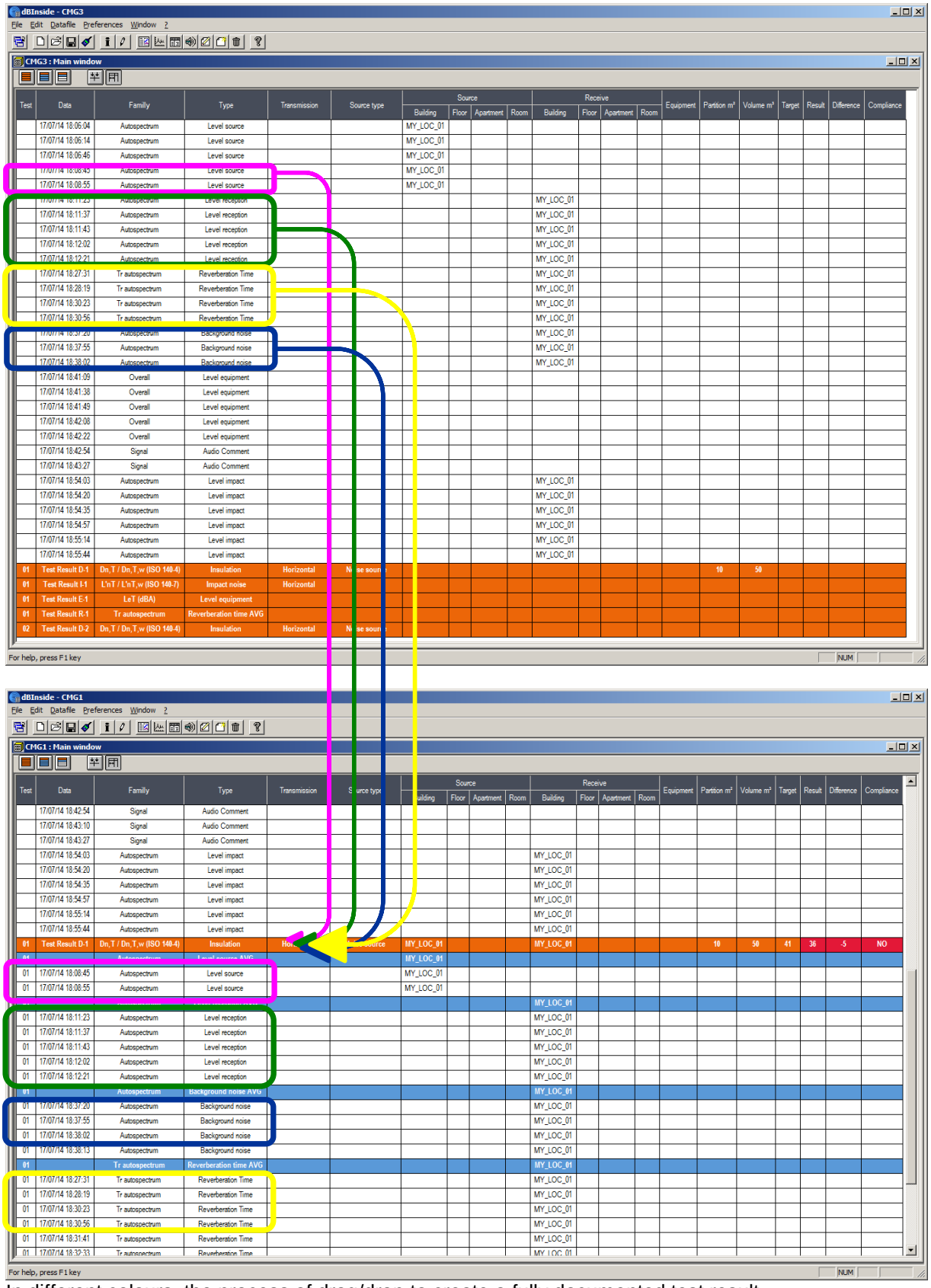
In pink and green, measurements have been duplicated and copied automatically for both Insulation and Impact noise Test Results

Not defined

In this mode (used necessary for SOLO and as a possibility for DUO/FUSION), the measured data are imported as individuals and are not assigned to any test result.in addition, when an import has been made using this option, the following test results are automatically created:

- Test Result D-1 Insulation,
- Test Result I-1 Impact noise
- Test Result E-1: Level equipment
- Test Result R-1: Reverberation time AVG

The user simply drags and drops (or copy/cut and paste from the menu Edit) the measurements in the corresponding test result line.


dBInside - CMG3
File Edit Datafile Preferences Window ?
CMG3 : Main window
dBInside - CMG1
File Edit Datafile Preferences Window ?
CMG1 : Main window

In different colours, the process of drag/drop to create a fully documented test result.

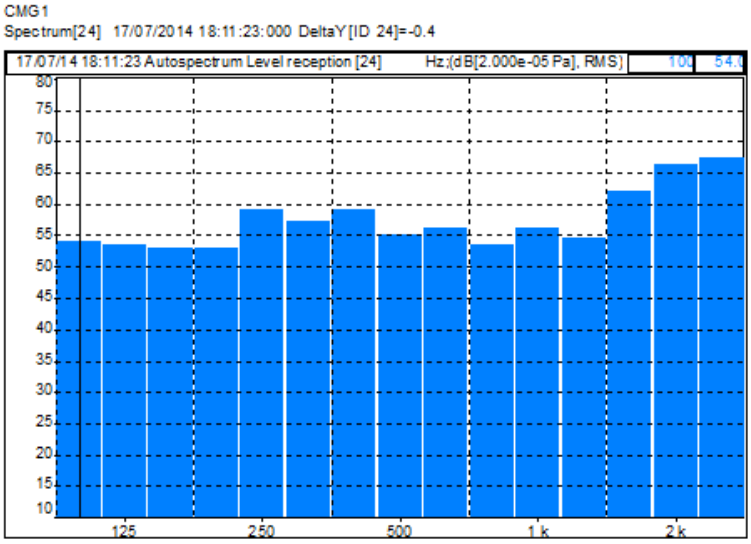
If different devices have been measured, the user has to create one new test result for each new device tested using the menu Datafile/Create (refer to § 0 Datafile).

8.2.1.7 *dBFileManager*

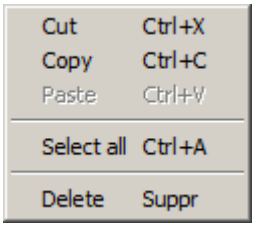
dBFileManager can transfer and concatenate data from DUO/FUSION in dBInside.
Please refer to dBFileManager user manual for more information.

8.2.1.8 *Print/Printpreview/Print setup*

After having displayed a plot or a list, the user can print the display. Using the commands of the File menu, results can be directly printed by dBBINSIDE, if a printer is connected to the computer. Use the command File / Print (CTRL + P) to display the Print dialog box. Specify which pages should be printed, the number of copies, and the printer driver to use as well as other parameters (print quality, etc.).
Print preview will visualize the result before printing

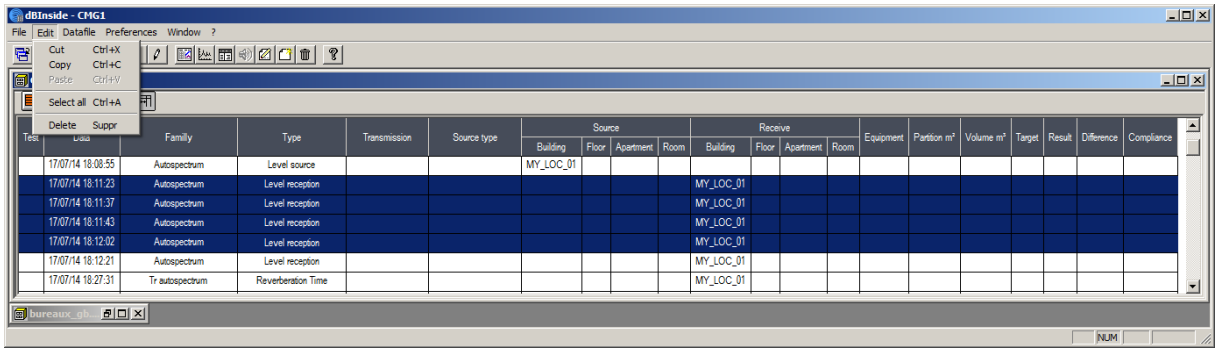


8.2.2 *Edit*

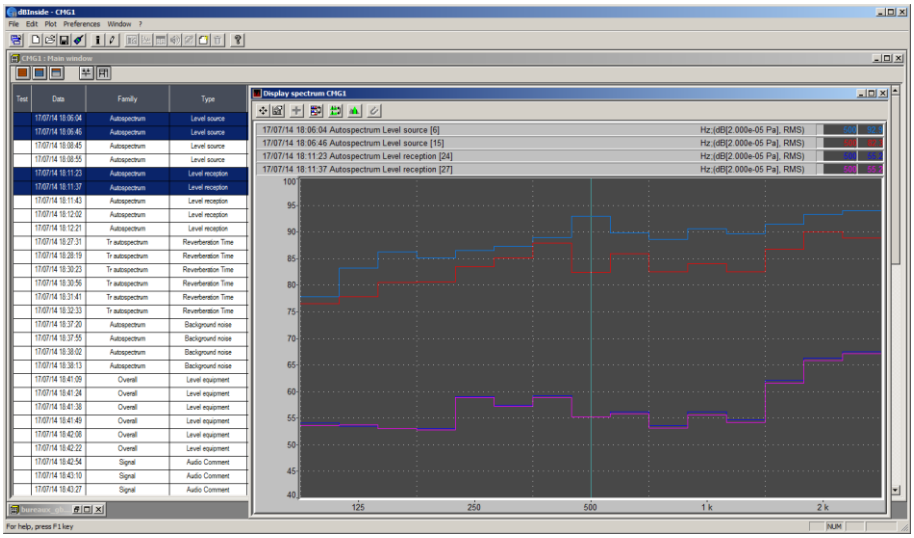


Depending on the type of information visualized, the edit function has different use:

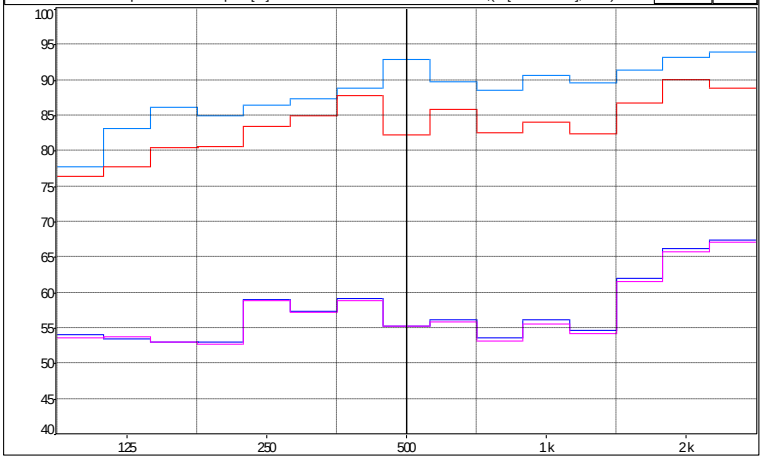
- If a measurement data in the information table is selected, the user can copy/cut and paste the data in one or several measurement results of the same type


dBInside - CMG1
File Edit Datafile Preferences Window ?
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Select all Ctrl+A
Delete Suppr
Test Data Family Type Transmission Source type Source Receive Equipment Partition m² Volume m³ Target Result Difference Compliance
Building Floor Apartment Room Building Floor Apartment Room
17/07/14 18:08:55 Autospectrum Level source MY_LOC_01
17/07/14 18:11:23 Autospectrum Level reception MY_LOC_01
17/07/14 18:11:37 Autospectrum Level reception MY_LOC_01
17/07/14 18:11:43 Autospectrum Level reception MY_LOC_01
17/07/14 18:12:02 Autospectrum Level reception MY_LOC_01
17/07/14 18:12:21 Autospectrum Level reception MY_LOC_01
17/07/14 18:27:31 Tr autospectrum Reverberation Time MY_LOC_01
NUM

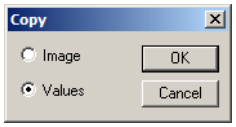
- If a graph is displayed, the user can copy and paste the graph

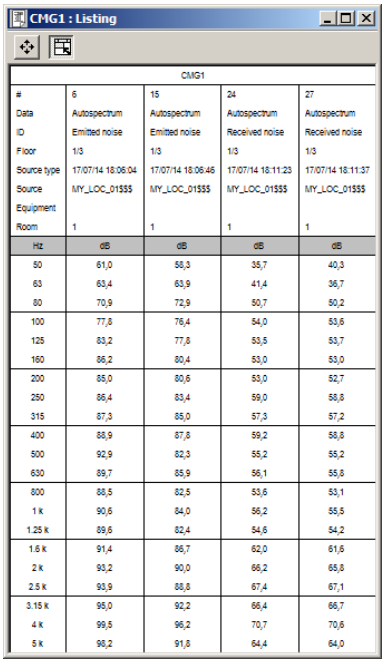

dBInside - CMG1
Display spectrum CMG1
17/07/14 18:06:04 Autospectrum Level source [6] Hz;(dB[2.000e-05 Pa], RMS)
17/07/14 18:06:46 Autospectrum Level source [15] Hz;(dB[2.000e-05 Pa], RMS)
17/07/14 18:11:23 Autospectrum Level reception [24] Hz;(dB[2.000e-05 Pa], RMS)
17/07/14 18:11:37 Autospectrum Level reception [27] Hz;(dB[2.000e-05 Pa], RMS)
125
250
500
1 k
2 k

17/07/14 18:06:04 Autospectrum Level source [6]	Hz;(dB[2.000e-05 Pa], RMS)	501	92.9
17/07/14 18:06:46 Autospectrum Level source [15]	Hz;(dB[2.000e-05 Pa], RMS)	501	82.3
17/07/14 18:11:23 Autospectrum Level reception [24]	Hz;(dB[2.000e-05 Pa], RMS)	501	55.2
17/07/14 18:11:37 Autospectrum Level reception [27]	Hz;(dB[2.000e-05 Pa], RMS)	501	55.2



- If a list is displayed, the user can either copy the values (to paste in a spreadsheet) or the table as an image file with the following window:

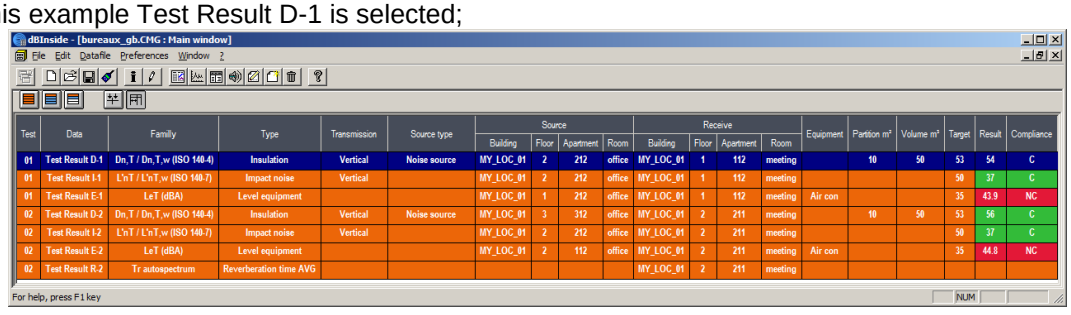




CMG1				
#	6	15	24	27
Data	Autospectrum	Autospectrum	Autospectrum	Autospectrum
ID	Emitted noise	Emitted noise	Received noise	Received noise
Floor	1/3	1/3	1/3	1/3
Source type	17/07/14 18:06:04	17/07/14 18:06:46	17/07/14 18:11:23	17/07/14 18:11:37
Source	MY_LOC_01$$$	MY_LOC_01$$$	MY_LOC_01$$$	MY_LOC_01$$$
Equipment				
Room	1	1	1	1
Hz	dB	dB	dB	dB
50	61,0	58,3	35,7	40,3
63	63,4	63,9	41,4	36,7
80	70,9	72,9	50,7	50,2
100	77,8	76,4	54,0	53,6
125	83,2	77,8	53,5	53,7
160	86,2	80,4	53,0	53,0
200	85,0	80,6	53,0	52,7
250	86,4	83,4	59,0	58,8
315	87,3	85,0	57,3	57,2
400	88,9	87,8	59,2	58,8
500	92,9	82,3	55,2	55,2
630	89,7	85,9	56,1	55,8
800	88,5	82,5	53,6	53,1
1 k	90,6	84,0	56,2	55,5
1.25 k	89,6	82,4	54,6	54,2
1.6 k	91,4	86,7	62,0	61,6
2 k	93,2	90,0	66,2	65,8
2.5 k	93,9	88,8	67,4	67,1
3.15 k	95,0	92,2	66,4	66,7
4 k	99,5	96,2	70,7	70,6
5 k	98,2	91,8	64,4	64,0

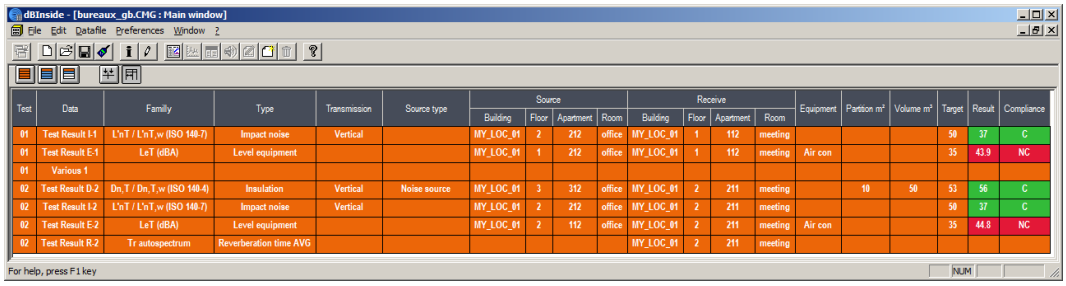
Image copied and pasted

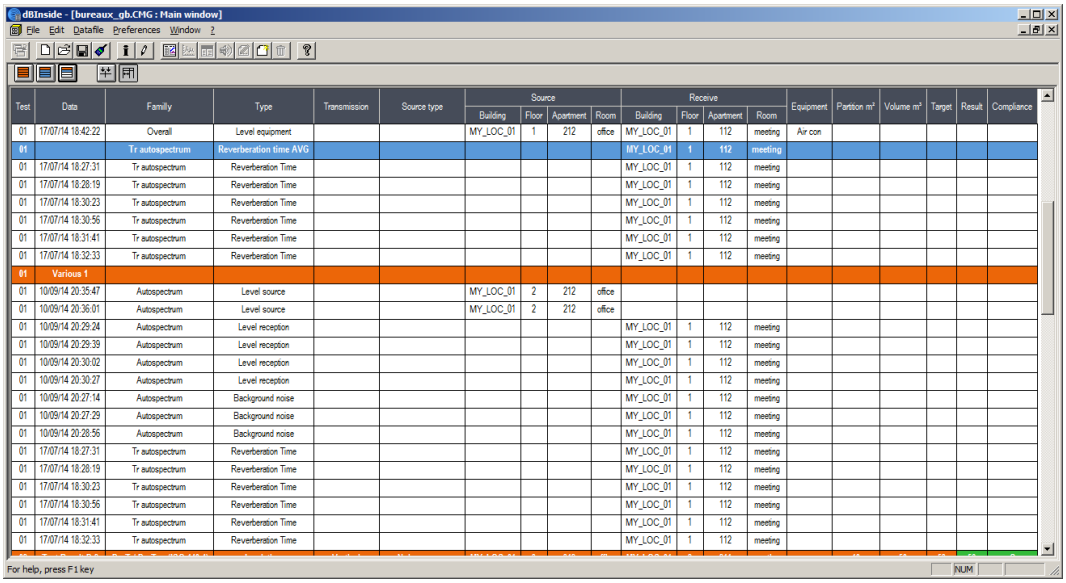
- Delete: by selecting one or several items and pressing Delete or menu Edit/Delete, the selected item will be suppressed from the calculations. Nevertheless the item (s) are not deleted: they are placed in a separate block called Various X where X is the number of the test
  In this example Test Result D-1 is selected;



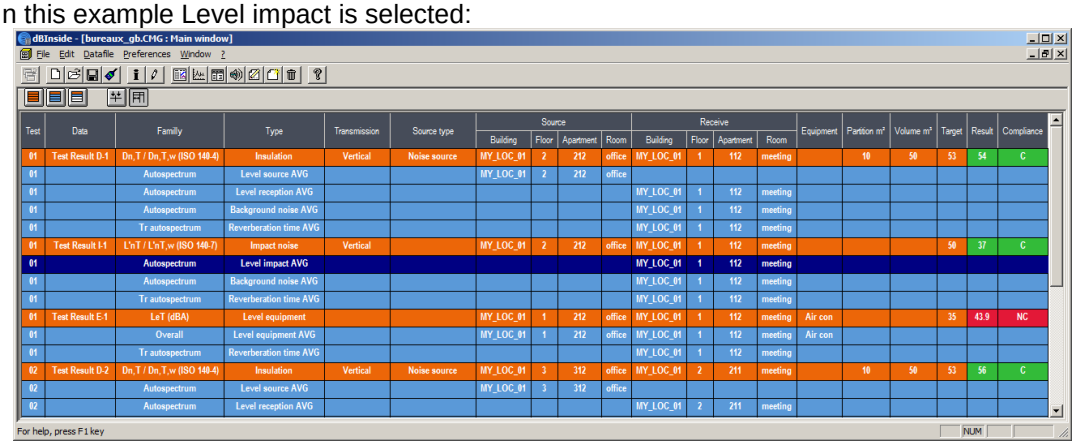
Test	Data	Familly	Type	Transmission	Source type	Source				Receive				Equipment	Partion m²	Volume m³	Target	Result	Compliance
						Building	Floor	Apartment	Room	Building	Floor	Apartment	Room						
01	Test Result D-1	Dn,T / Dn,T,w (ISO 140-4)	Insulation	Vertical	Noise source	MY_LOC_01	2	212	office	MY_LOC_01	1	112	meeting		10	50	53	54	C
01	Test Result I-1	L'nT / L'nT,w (ISO 140-7)	Impact noise	Vertical		MY_LOC_01	2	212	office	MY_LOC_01	1	112	meeting				50	37	C
01	Test Result E-1	LeT (dBA)	Level equipment			MY_LOC_01	1	212	office	MY_LOC_01	1	112	meeting	Air con			35	43.9	NC
02	Test Result D-2	Dn,T / Dn,T,w (ISO 140-4)	Insulation	Vertical	Noise source	MY_LOC_01	3	312	office	MY_LOC_01	2	211	meeting		10	50	53	56	C
02	Test Result I-2	L'nT / L'nT,w (ISO 140-7)	Impact noise	Vertical		MY_LOC_01	2	212	office	MY_LOC_01	2	211	meeting				50	37	C
02	Test Result E-2	LeT (dBA)	Level equipment			MY_LOC_01	2	112	office	MY_LOC_01	2	211	meeting	Air con			35	44.8	NC
02	Test Result R-2	Tr autospectrum	Reverberation time AVG							MY_LOC_01	2	211	meeting						

By pressing the key “Delete”, all items inside Test Result D-1 are placed below a new item called Various 1

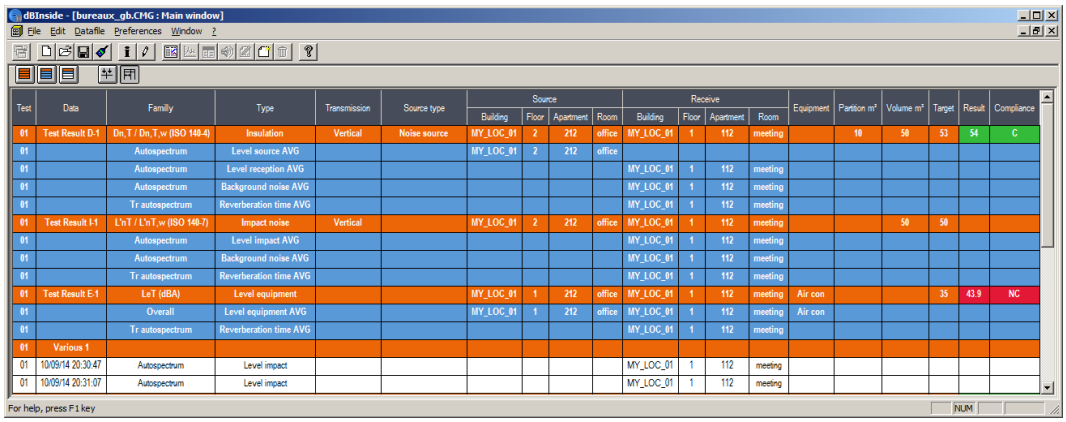




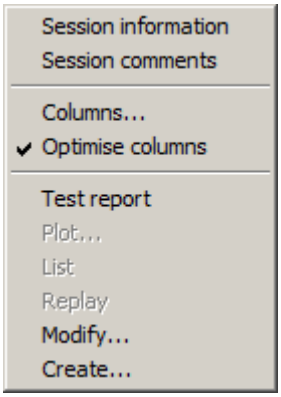
In this example Level impact is selected:



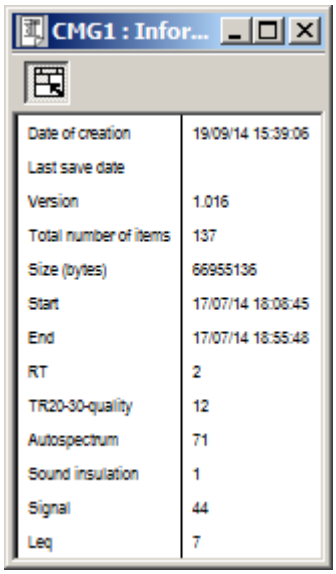
By pressing the key “Delete”, all Level impact items are placed below a new item called Various 1


dBInside - [bureaux_gb.CMG : Main window]
File Edit Datafile Preferences Window ?
Test Data Family Type Transmission Source type Source Receive Equipment Partition m² Volume m³ Target Result Compliance
Building Floor Apartment Room Building Floor Apartment Room
01 Test Result D-1 Dn,T / Dn,T,w (ISO 140-4) Insulation Vertical Noise source MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 10 50 53 54 C
01 Autospectrum Level source AVG MY_LOC_01 2 212 office
01 Autospectrum Level reception AVG MY_LOC_01 1 112 meeting
01 Autospectrum Background noise AVG MY_LOC_01 1 112 meeting
01 Tr autospectrum Reverberation time AVG MY_LOC_01 1 112 meeting
01 Test Result I-1 L'nT / L'nT,w (ISO 140-7) Impact noise Vertical MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 50 50
01 Autospectrum Level impact AVG MY_LOC_01 1 112 meeting
01 Autospectrum Background noise AVG MY_LOC_01 1 112 meeting
01 Tr autospectrum Reverberation time AVG MY_LOC_01 1 112 meeting
01 Test Result E-1 LeT (dBA) Level equipment MY_LOC_01 1 212 office MY_LOC_01 1 112 meeting Air con 35 43.9 NC
01 Overall Level equipment AVG MY_LOC_01 1 212 office MY_LOC_01 1 112 meeting Air con
01 Tr autospectrum Reverberation time AVG MY_LOC_01 1 112 meeting
01 Various 1
01 10/09/14 20:30:47 Autospectrum Level impact MY_LOC_01 1 112 meeting
01 10/09/14 20:31:07 Autospectrum Level impact MY_LOC_01 1 112 meeting
For help, press F1 key
NUM

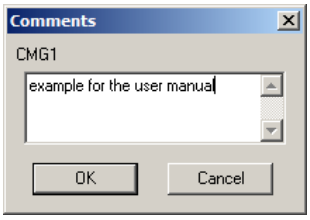
8.2.3 *Datafile*



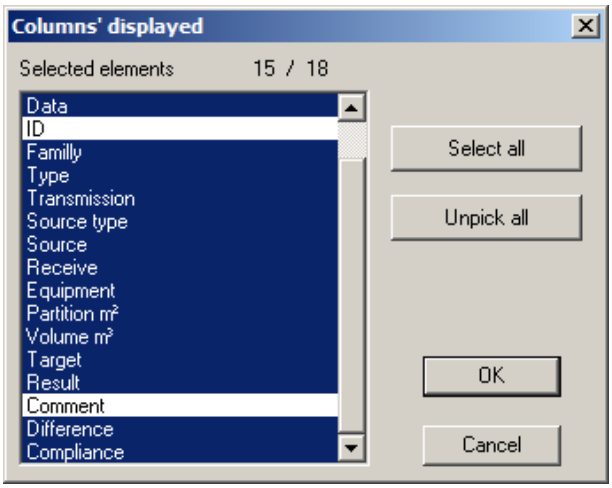
- Session information: Use the command Datafile / Session Information to display the information window of the active measurement session. The following information is given in this window:



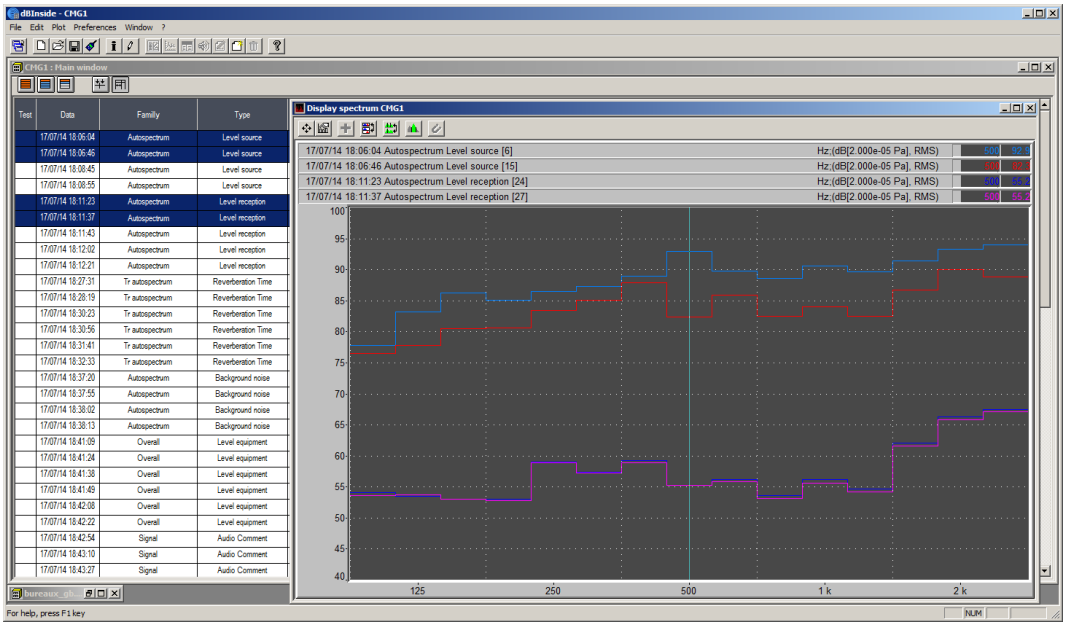
- Session comments: Use the command Datafile / Session comments to input a general comment for the active measurement session datafile.



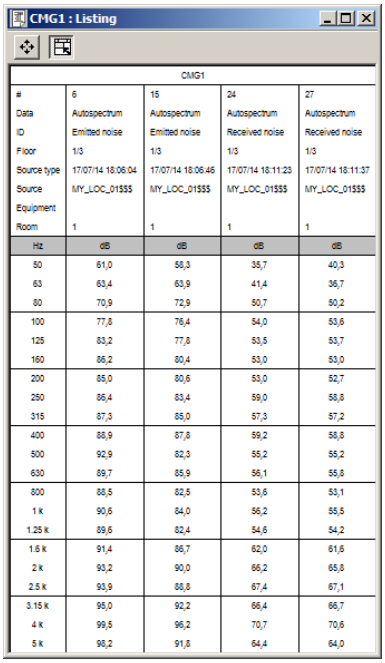
- Columns: Use the command Datafile / Columns to select the columns that will be displayed in the main window of a measurement session data file. The dialog box shown below appears on screen. Select with the mouse the different column fields that will be displayed in the information table of a measurement session data file. The key Select all allows the user to select all possible columns fields while the key Unpick all allows the user to clear all the column fields.



- Optimize columns: ticking the field automatically optimizes the columns width
- Test report: either select Test report or press the command to generate an automatic report in Excel.
- Plot: displays the plot of the selected data

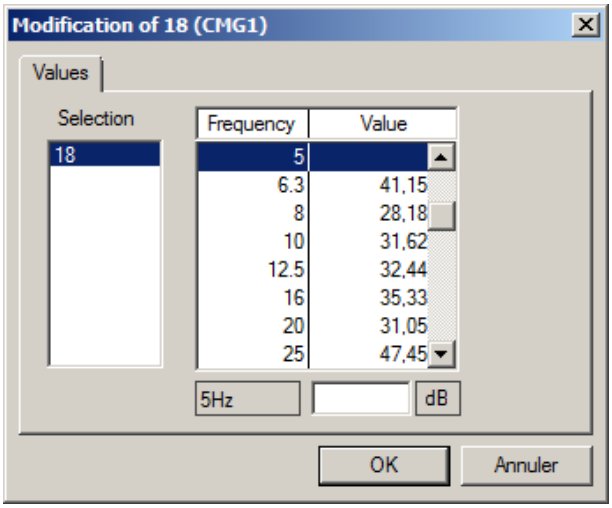


- List: lists the values of the selected data

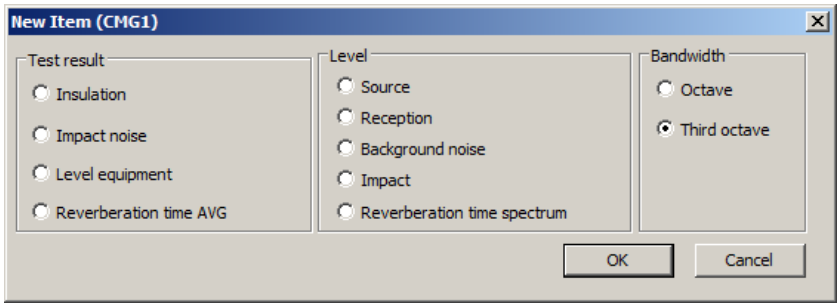


- Replay: when this field is active (single measurement selected) the user can playback the corresponding measurement by selecting Replay or by pressing the command

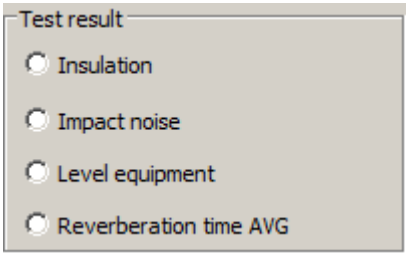
- Modify: a created spectrum from the menu Create below can be modified in the following window:



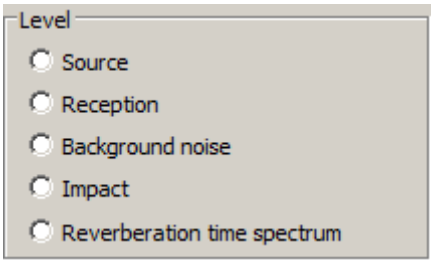
- Create: the user can manually create all types of data;



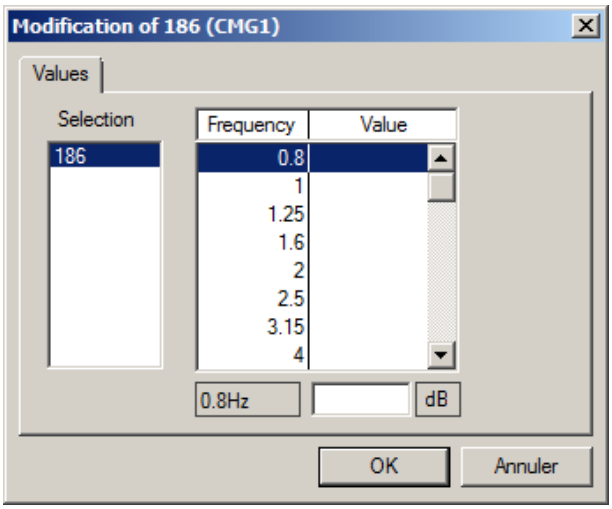
Selecting a test result automatically generates a new orange line in the table of information;



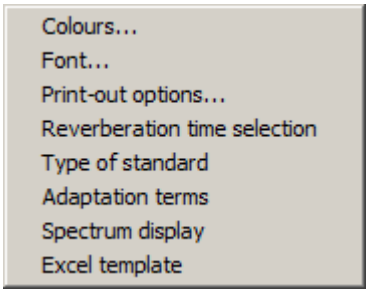
Selecting a Level opens a new window to create a Level spectrum



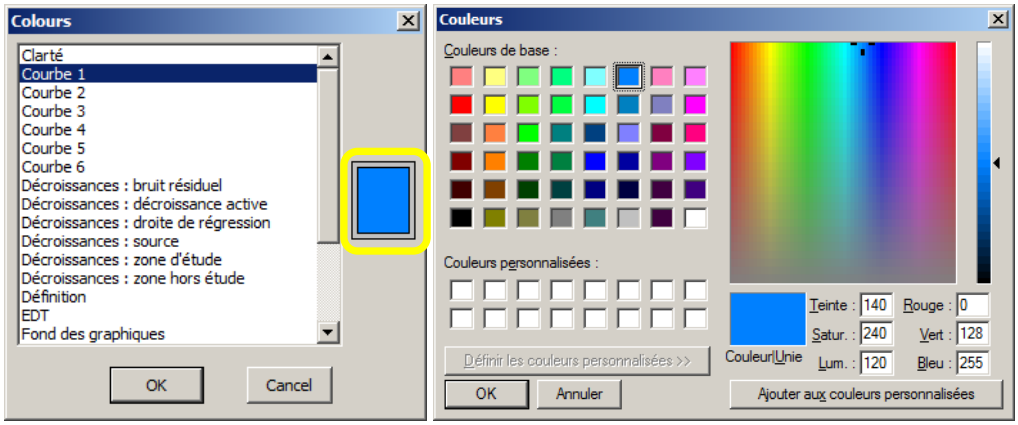
After having entered the data manually (ensure to press the command “dB” after entering each value), when pressing OK this item will be added to the current measurement campaign.



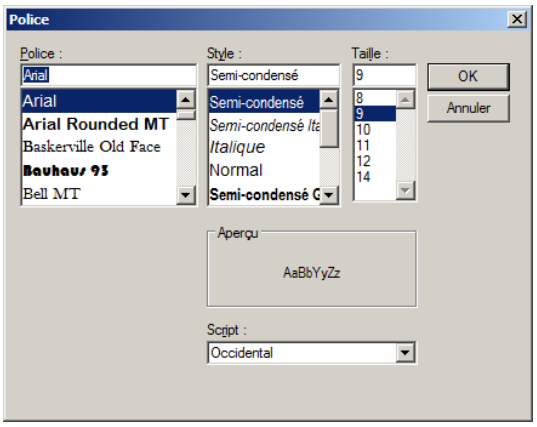
8.2.4 *Preferences*



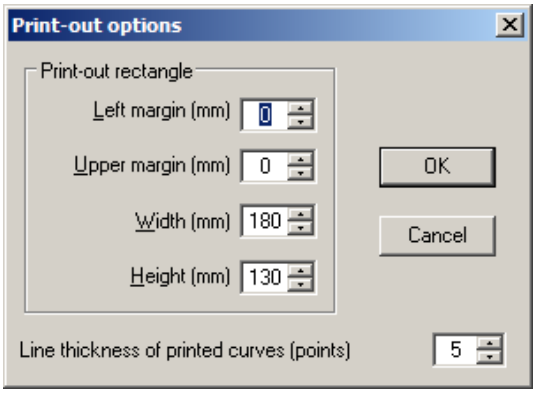
- Colours : The commands Preferences / Colours allows the user to respectively set the colours of the different types of data displayed on screen. Select in this list the type of data for which you want to modify the colour. The actual colour associated to this type of data is displayed next to the list. Then, select the new colour in the coloured part of the dialog box. Click on OK when all the modifications have been carried out.



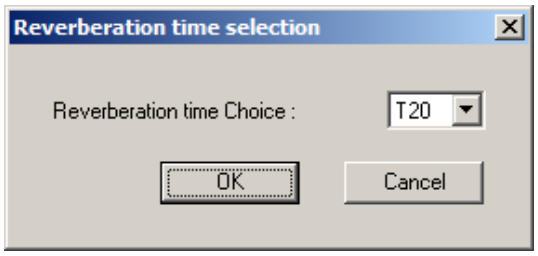
- Font: window to select the type, style and size of the fonts used in dBInside



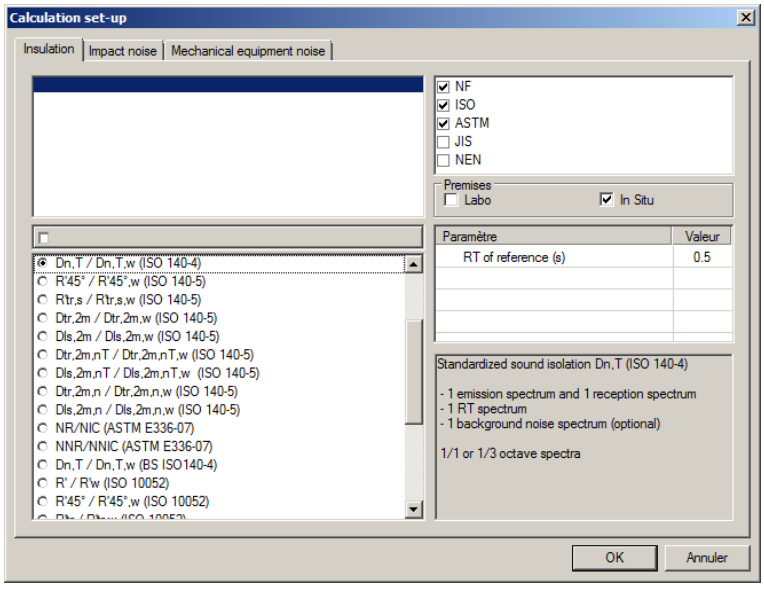
- Print-out options…: window to select the print out options. When printing graphics, the user can set a few additional parameters by the commands Preferences / printout options. The user can set the margins of the graphic printout frame and the line thickness of the printed curves.



- Reverberation time selection: window to select the reverberation time to be used for the calculation; possible selection T20 or T30.

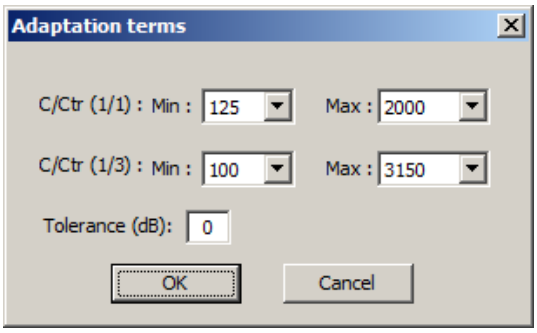


- Type of standard:



Select from each tab the standard to be used for the calculation. Depending on the type of parameters needed for the calculation, the right window allows to edit reference values (Reference RT, Reference surface, …)and specific characteristics of the device under test (Volume of the receiving room, surface of the device). These values are default values and can be modified by the user.
Note: the surface of the device under test and the volume of the receiving room can also be entered directly in the table of information. In that case the result is updated with the values entered in the table of information but the default values remain in the calculation setup window.

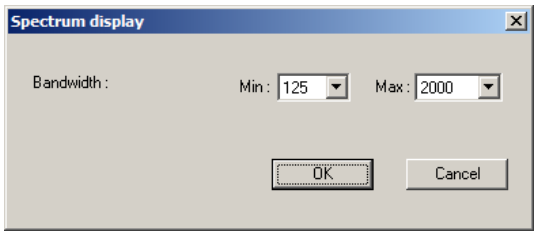
- Adaptation terms: window to select the 1/1 oct and the 1/3 oct lower and upper limits of the adaptation terms to limit the reference curve for the calculation of the ratings.



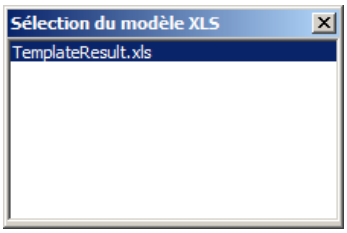
- Tolerance: some countries use a tolerance when comparing a measured result to a limit fixed by local legislation. In the table of information, the column Compliance indicated whether the device under test is compliant (C), Compliant with tolerance (CT) or non compliant (NC)

Target	Result	Compliance	Comment
53	52	CT	Correction BF - R-BN<6dB !
50	37	C	Correction BF - R-BN<6dB !
35	43.9	NC	
53	54	C	Correction BF - R-BN<6dB !
50	37	C	Correction BF - R-BN<6dB !
35	44.8	NC	

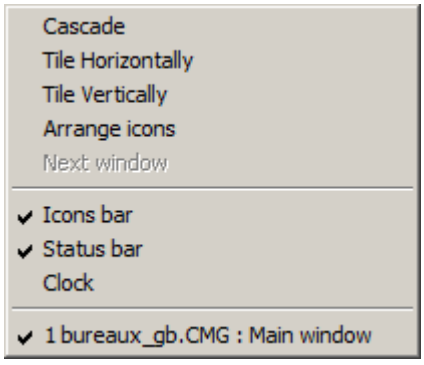
- Spectrum display: window to select the lower and upper limits for the spectra displayed (selectable values in 1/1 oct even for 1/3 oct spectra).



- Excel template: window to select the template to be used for reports. It is possible to create other templates based on the TemplateResult.xls default one. The files must be placed in: \\ProgramData\01dB\dBInside.



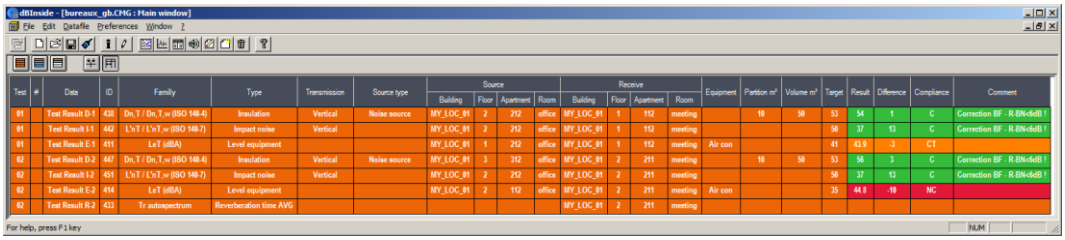
8.2.5 *Window*



Typical menu for managing the displayed windows

8.3 TABLE OF INFORMATION

8.3.1 *Overall description*



The table of information is the list of all the different items present for a measurement campaign. It can be displayed in 3 different modes.
This interface comprises three levels which may be expanded simply by clicking on an icon. These three levels correspond to:

- Level 1: concatenated: Standardized test results (orange items)
- Level 2: more information: add of averaged measurements (blue items)
- Level 3: all information: add of all stored measured data (white items

8.3.2 *Description of the columns:*

- Test: the number corresponds to the test # when measurement are performed using DUO/FUSION. Refer to § 2.3 Description of the data organization, 2.4 Creation of the data structure as you measure and 6.3.3 Tests list for additional information)

- #: for later use

- Data:
    - for a measurement it corresponds to the date of acquisition
    - for an average level, no specific data in this field
    - for calculated result, the data is called Test Result

- ID: unique value corresponding to the ID of the item. This number is incremented (from 0) each time a data item is added to the measurement session.

- Family:
    - Result type: describes the result values selected for standards calculation
    - Autospectrum: spectrum of data (measured or averaged)
    - Tr Autospectrum: spectrum of reverberation time
    - Overall: one single value
    - Signal: data stored as audio comment

- Type
    - Insulation: result data for an insulation test
    - Impact noise: result data for an impact noise test
    - Level equipment: result data for an equipment test
    - Reverberation time AVG: this item is created if only reverberation time measurements have been performed in the measurement campaign

- Transmission
    - For insulation: selection between horizontal, vertical, diagonal or façade. If façade is selected, then the result column displays the rating corresponding to Ctr; if another transmission type is selected, the result column displays the rating corresponding to C
    - For impact noise selection between horizontal, vertical or diagonal

- Source type: for insulation only: to distinguish between excitation made by a noise source or directly by the traffic noise (for façade insulation)

- Source: editable fields in Test Result items
    - Building: repeats automatically the location of the DUO/FUSION data structure.
    - Floor, apartment and room: can be edited by the user and are reported in the report
      The information is copied in
    - Level source AVG
    - all Level source measurements
- Receive: editable fields in Test Result items
    - Building: repeats automatically the location of the DUO/FUSION data structure.
    - Floor, apartment and room: can be edited by the user and are reported in the report
      The information is copied in
    - Level Receive AVG
    - Impact noise AVG
    - Background noise AVG
    - Reverberation time AVG
    - all Level reception measurements
    - all Level impact
    - all Background noise
    - All reverberation time

- Equipment: editable field in Level equipment Test result line
      The information is copied in
    - Level equipment AVG
    - Level equipment measured data

- Partition m²: editable field in Test Result items: to be used when the calculation method requires the surface of the device under test

- Volume m3: editable field in Test Result items: to be used when the calculation method requires the volume of the receiving room under test

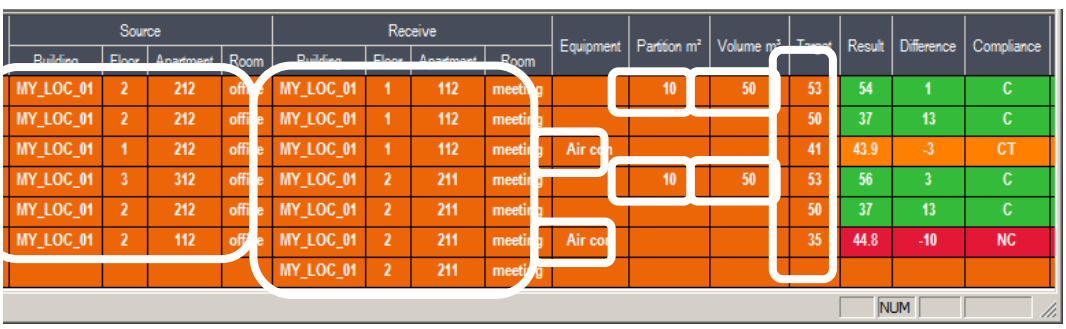
- Target: editable field in Test Result items for use to compare a result when a target is required (maximum value for impact noise, minimum value for the other test results)

- Result: rated calculated value

- Difference: difference between the target value and the measured rated calculated value

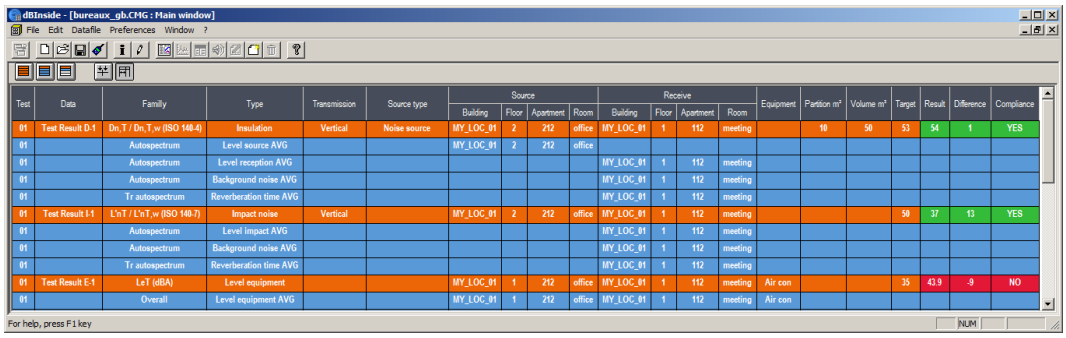
- Compliance:
    - C: compliant
    - CT: compliant with tolerance
    - NC: not compliant

- Comment: information when an indicator is not fulfilled (refer to §10.4 Background noise correction for more information).


Source
Receive
Equipment
Partition m²
Volume m³
Target
Result
Difference
Compliance
Building
Floor
Apartment
Room
MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 10 50 53 54 1 C
MY_LOC_01 2 212 office MY_LOC_01 1 112 meeting 50 37 13 C
MY_LOC_01 1 212 office MY_LOC_01 1 112 meeting Air co 41 43.9 -3 CT
MY_LOC_01 3 312 office MY_LOC_01 2 211 meeting 10 50 53 56 3 C
MY_LOC_01 2 212 office MY_LOC_01 2 211 meeting 50 37 13 C
MY_LOC_01 2 112 office MY_LOC_01 2 211 meeting Air co 35 44.8 -10 NC
MY_LOC_01 2 211 meeting
NUM

Summary of editable fields highlighted in white

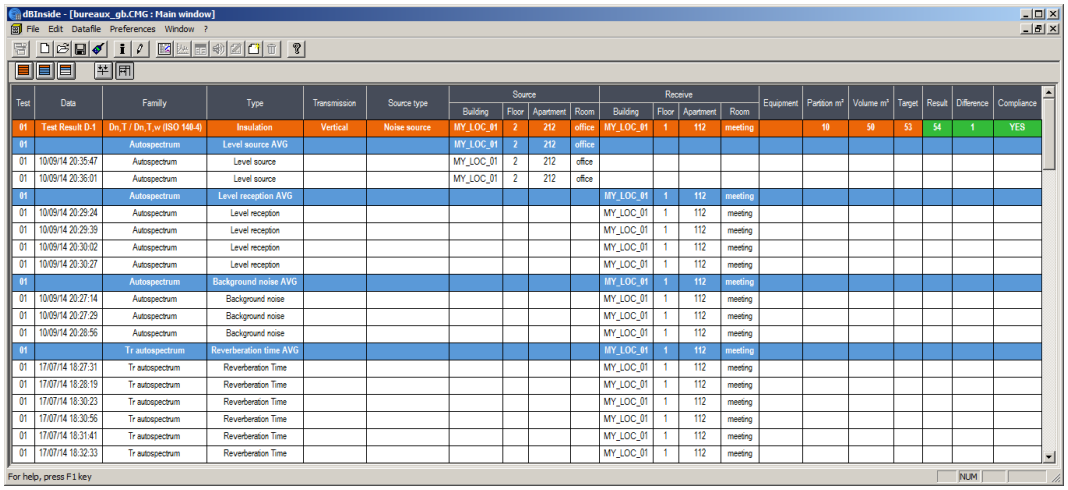
8.3.3 *Level 2: Averaged measurements level*



Test	Data	Family	Type	Transmission	Source type	Source				Receive				Equipment	Partition m²	Volume m³	Target	Result	Difference	Compliance
						Building	Floor	Apartment	Room	Building	Floor	Apartment	Room							
01	Test Result D-1	Dn,T / Dn,T,w (ISO 140-4)	Insulation	Vertical	Noise source	MY_LOC_01	2	212	office	MY_LOC_01	1	112	meeting		10	50	53	54	1	YES
01		Autospectrum	Level source AVG			MY_LOC_01	2	212	office											
01		Autospectrum	Level reception AVG							MY_LOC_01	1	112	meeting							
01		Autospectrum	Background noise AVG							MY_LOC_01	1	112	meeting							
01		Tr autospectrum	Reverberation time AVG							MY_LOC_01	1	112	meeting							
01	Test Result I-1	L'nT / L'nT,w (ISO 140-7)	Impact noise	Vertical		MY_LOC_01	2	212	office	MY_LOC_01	1	112	meeting				50	37	13	YES
01		Autospectrum	Level impact AVG							MY_LOC_01	1	112	meeting							
01		Autospectrum	Background noise AVG							MY_LOC_01	1	112	meeting							
01		Tr autospectrum	Reverberation time AVG							MY_LOC_01	1	112	meeting							
01	Test Result E-1	LeT (dBA)	Level equipment			MY_LOC_01	1	212	office	MY_LOC_01	1	112	meeting	Air con			35	43.9	-9	NO
01		Overall	Level equipment AVG			MY_LOC_01	1	212	office	MY_LOC_01	1	112	meeting	Air con						

Averaged measurement levels appear in blue and correspond to the averaged result according to the different standards calculation.

8.3.4 *Level 3: Single measurements level*



Test	Data	Family	Type	Transmission	Source type	Source				Receive				Equipment	Partition m²	Volume m³	Target	Result	Difference	Compliance
						Building	Floor	Apartment	Room	Building	Floor	Apartment	Room							
01	Test Result D-1	Dn,T / Dn,T,w (ISO 140-4)	Insulation	Vertical	Noise source	MY_LOC_01	2	212	office	MY_LOC_01	1	112	meeting		10	50	53	54	1	YES
01		Autospectrum	Level source AVG			MY_LOC_01	2	212	office											
01	10/09/14 20:35:47	Autospectrum	Level source			MY_LOC_01	2	212	office											
01	10/09/14 20:36:01	Autospectrum	Level source			MY_LOC_01	2	212	office											
01		Autospectrum	Level reception AVG							MY_LOC_01	1	112	meeting							
01	10/09/14 20:29:24	Autospectrum	Level reception							MY_LOC_01	1	112	meeting							
01	10/09/14 20:29:39	Autospectrum	Level reception							MY_LOC_01	1	112	meeting							
01	10/09/14 20:30:02	Autospectrum	Level reception							MY_LOC_01	1	112	meeting							
01	10/09/14 20:30:27	Autospectrum	Level reception							MY_LOC_01	1	112	meeting							
01		Autospectrum	Background noise AVG							MY_LOC_01	1	112	meeting							
01	10/09/14 20:27:14	Autospectrum	Background noise							MY_LOC_01	1	112	meeting							
01	10/09/14 20:27:29	Autospectrum	Background noise							MY_LOC_01	1	112	meeting							
01	10/09/14 20:28:56	Autospectrum	Background noise							MY_LOC_01	1	112	meeting							
01		Tr autospectrum	Reverberation time AVG							MY_LOC_01	1	112	meeting							
01	17/07/14 18:27:31	Tr autospectrum	Reverberation Time							MY_LOC_01	1	112	meeting							
01	17/07/14 18:28:19	Tr autospectrum	Reverberation Time							MY_LOC_01	1	112	meeting							
01	17/07/14 18:30:23	Tr autospectrum	Reverberation Time							MY_LOC_01	1	112	meeting							
01	17/07/14 18:30:56	Tr autospectrum	Reverberation Time							MY_LOC_01	1	112	meeting							
01	17/07/14 18:31:41	Tr autospectrum	Reverberation Time							MY_LOC_01	1	112	meeting							
01	17/07/14 18:32:33	Tr autospectrum	Reverberation Time							MY_LOC_01	1	112	meeting							

Single measurements level appear in white and correspond to the single measurements.

Chapter 9
REVERBERATION TIME CALCULATION ALGORITHM

The reverberation time calculation is performed from the decay curves on each of the selected frequency bands. These decay curves are generated at the time of frequency analysis of the recorded signal. Reverberation time calculation is performed according to ISO 3382 standard in the instrument and in dBInside.

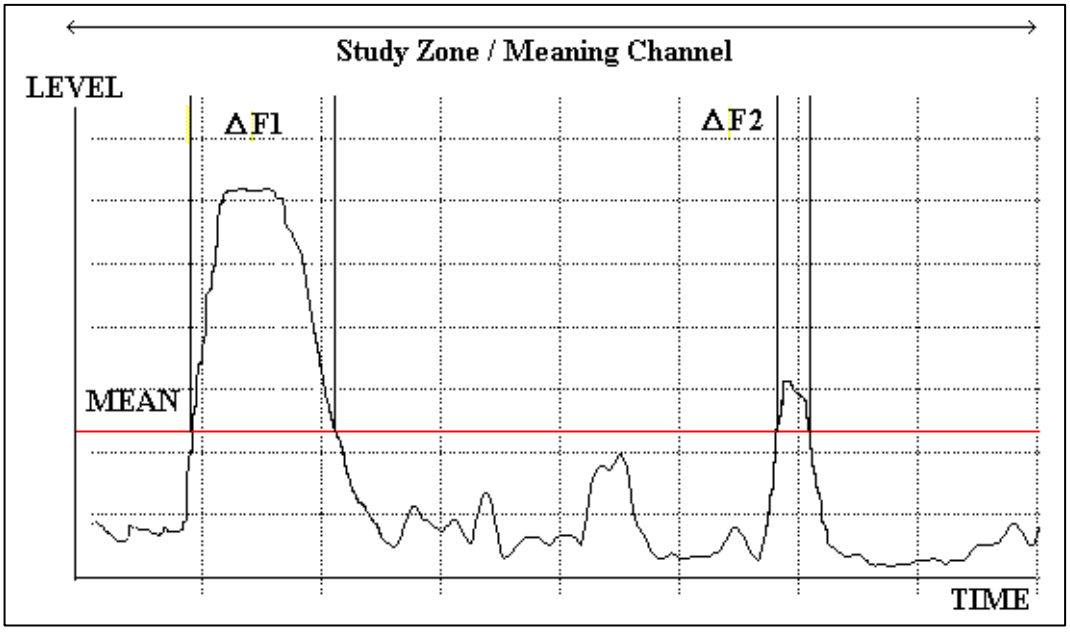
The reverberation time calculation is divided into the following steps:

9.1 DETERMINATION OF SIGNAL EMERGENCE AND SIGNIFICANT SEQUENCE

Terminology

Reference band: The reference band is the medium frequency band of the considered frequency range i.e. when using the standardised 125 Hz to 4 kHz octave bands, the meaning channel is 500 Hz.

Study zone: The study zone is the time section of the decay taken into account for the RT computation. As default value, the study zone is the complete duration of the original signal file. It may be changed in order to improve the result using the observation window.



This step is dedicated to identifying the section of the decay curve to be taken into account for the RT calculation. From the decay curve of the reference band, the program calculates the average level between the limits of the study zone. It checks the sequences of the decay curve where the level exceeds the average value and retains the largest value. This is the sequence on which the following computation will be performed. In the figure above the first sequence will be considered.

9.2 DETERMINATION OF THE PRE-SEQUENCE NOISE (PRSN), SEQUENCE STARTING POINT (SSP) AND SEQUENCE CUT OFF POINT (SCOP).

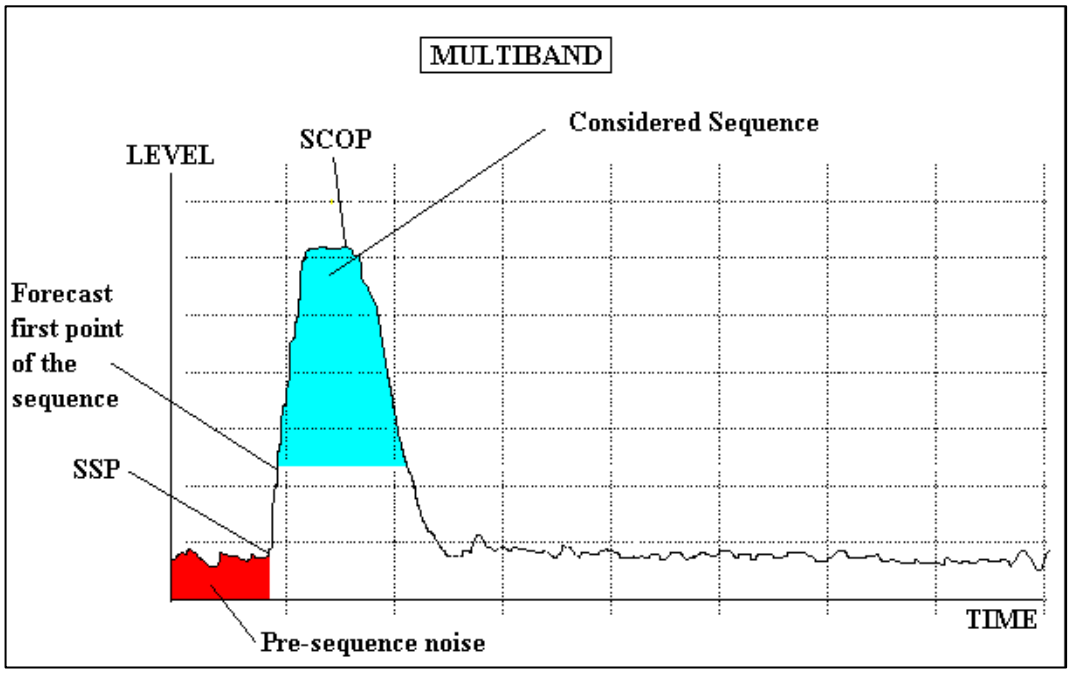
Terminology:

PRSN: The pre-sequence noise is the noise level prior to the source generation. The PRSN is frequency band independent

SSP: The sequence starting point is the point on the decay where the sequence starts. This point is defined in multi band mode. The SSP is frequency band independent

SCOP: The sequence cut off point is the point on the decay curve where the noise source has been interrupted. The SCOP is frequency band independent.

MULTI BAND: The multi band mode means that computation is performed taking into account all considered bands with particular weighting. The weighting consists in giving more importance to the high frequency bands than the low ones.

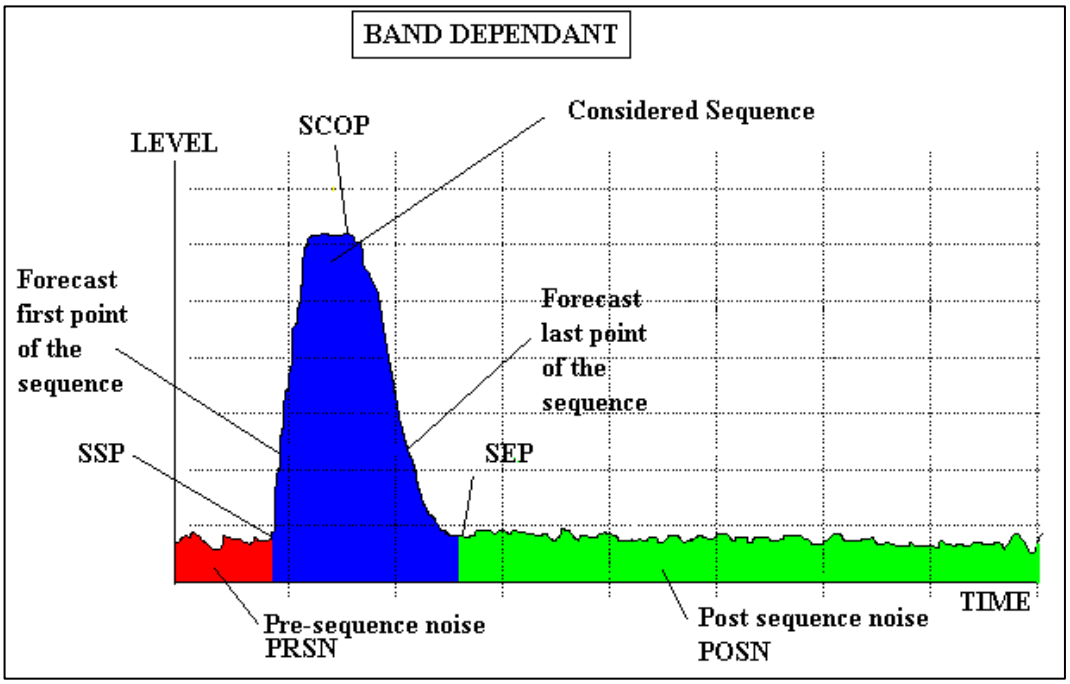


At this stage, the aim is to define the SSP and SCOP common to all decay curves. From the forecast first point of the sequence (see figure above), a recursive algorithm is applied to define the SSP. On the other hand, the determination of the SCOP point is performed. At the end of the process, the SSP and SCOP co-ordinates as well as the PRSN level are known.

9.3 DETERMINATION OF THE SEQUENCE ENDING POINT (SEP) AND POST-SEQUENCE NOISE (POSN) ON EACH OF THE CONSIDERED FREQUENCY BANDS.

Terminology

SEP The sequence ending point is the point where the decay ends and the post-sequence noise starts. The SEP is frequency band dependent



POSN: The post-sequence noise is the noise level once the decay itself has ended. The POSN is frequency band dependent.

For each of the considered frequency bands, this stage is dedicated to defining the SEP and the POSN. To do so, the same type of algorithm as during the SSP and PRSN determination is applied. Once completed, on each band, the limits on the decay curves to be taken into account for the reverberation time calculation are known.

Depending upon the RT calculation parameters, the integration as described by Schröeder and the POSN subtraction may be performed prior to calculating the RT values. When using a source cut-off noise, the next step is bypassed.

9.4 APPLYING INTEGRATION (SCHRÖEDER THEOREM) AND POSN SUBTRACTION WHEN USING AN IMPULSIVE NOISE

The 01dB program allows you to perform an integration (as defined by SCHRÖEDER in 1965) as well as POSN subtraction when using an impulsive noise.

As a matter of fact, the data measured from an impulsive noise represents the impulsive response of the room and should not be used directly to calculate the reverberation time.

When using the integration, it is also recommended that the POSN subtraction be performed in order to obtain reliable results.

The program allows you to perform the integration without POSN subtraction and in this case, the results are the user's responsibility

In 1965, SCHRÖEDER proved the identity between the square of the impulsive response of a room and the average of the decay curves due to a source cut off.

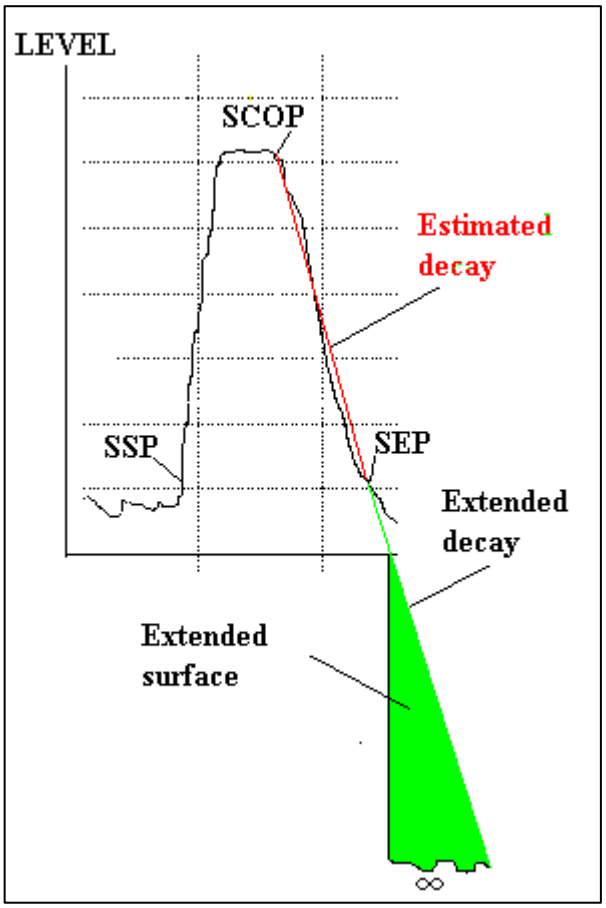
It is expressed by the following formula : $\langle S_d^2(t) \rangle = N * \int_0^\infty r^2(x)dx$

where :
S2(t) the mean sound intensity of the decay at t
r(t) the impulsive response

t = 0 is the source cut-off
N represents the source sound power

As the integral has to be calculated to the infinite according to the formula, it is not possible to perform a reliable RT calculation without using the POSN subtraction as the recording is finite.

The figure below shows the principle of the integration using the POSN subtraction**.**



An estimated decay curve is defined using a linear regression between the SCOP and SEP points.

This decay curve is extended to infinity. Therefore, the integration between the SCOP point and infinity is possible as the surface of the triangle (extended surface) is known.

At the end of the process, the reliable decay curves are completely defined and the RT determination is applied.

9.5 REVERBERATION TIME CALCULATION ACCORDING TO THE USER DEFINED PARAMETERS.

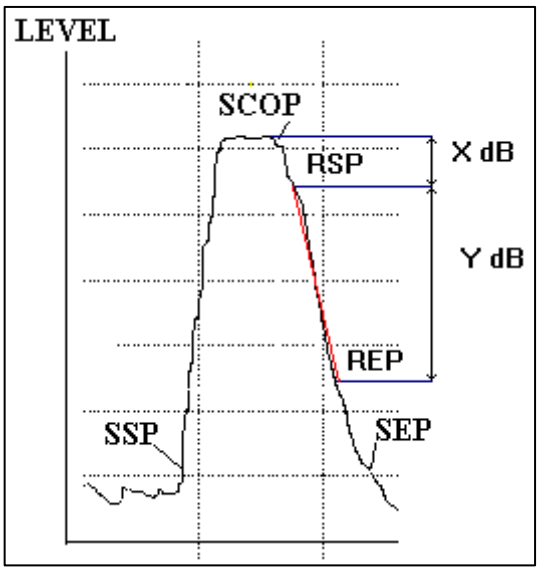
User defined parameters

X : Start (dB) Defines the regression starting point (RSP) on the decay curve to be considered for the linear regression calculation. The RSP point is defined as being the point on the decay which is X decibels below the level of the SCOP. The RSP point is frequency dependent.

Y : Dynamic (dB) Defines the regression ending point (REP). The REP point is defined as being the point on the decay curve which is Y decibels below the RSP point. The REP point is frequency dependent.

Strict The strict option disables the calculation on the band where it is not possible to define the REP point i.e. if the decays dynamic range is lower than Y -X. In this case, the RT value for the corresponding band is not calculated.

The figure below shows the principle of the RT value calculation



The Reverberation time for the corresponding frequency band is calculated as being the slope of the linear regression between the RSP and REP.

In the case where the REP cannot be calculated (below the SEP), when using the strict option, the RT is not calculated whereas when disabling it, the RT is calculated between the RSP and the SEP.

Once the RT is calculated, the program displays the correlation between the linear regression and the points of the decay curve. The RT computation process is ended.

Chapter 10
STANDARDS

10.1 INSULATION

French standard	Raw level difference D	Standardised level difference DnT	A weighted standardised level difference DnAT (with reference to Pink noise or Road traffic noise)
Standard	NF S 31-057	NF S 31-057	NF S 31-057
Inputs	- 1 emitted noise spectrum - 1 received noise spectrum - Optionally, 1 background noise spectrum	- 1 emitted noise spectrum - 1 received noise spectrum - 1 RT spectrum - Optionally, 1 background noise spectrum	- 1 Standardised level difference spectrum DnT
Parameters		Reference RT value	
Frequencies	- Octaves or third octaves	- Octaves or third octaves	- Octaves or third octaves - The DnT spectrum must comprise all frequency bands in the range 100 - 5000 Hz in third octaves, or 125 - 4000 Hz in octaves
Computation	Per frequency band : D = L1 – L2 (dB) L1 : Emitted noise level L2 : Received noise level If background noise spectrum as an input, there is an additional correction. (cf (1))	Per frequency band : DnT = D + 10 lg (T / T0) (dB) T : RT reception room T0 : Reference RT value The lower limit of the T duration is 0.4 s. If the measured value is less than this limit, T=0.4s for the calculation. If background noise spectrum as an input, there is an additional correction. (cf (1))	Calculation for the frequency bands in the range 100 - 5000 Hz in third octaves, or 125 - 4000 Hz in octaves j : indice of the frequency band m : 6 for octaves measurements 18 for third octaves measurements Sj : Level for the frequency band j of the reference emitted noise spectrum for which the calculation is made (pink noise or road traffic noise) (Cf Table 1) Cj : A weighting value for the frequency band j (Cf Table 2) DnTj : Value of the standardised level difference for the frequency band j A weighted overall level of the theoretical emitted noise spectrum : $XE = 10\lg\left(\sum_{j=1}^{m} 10^{(Sj+Cj)/10}\right)$ A weighted overall level of the theoretical received noise spectrum : $XR = 10\lg\left(\sum_{j=1}^{m} 10^{(Sj-DnTj+Cj)/10}\right)$ **DnAT = XE – XR (in dBA)**
Limitations	Cf background noise correction (1)	Cf background noise correction (1)	
Result	Result per octave or third octave bands, over the whole frequency of the input spectra quantities D	Result per octave or third octave bands, over the whole frequency of the input spectra quantities DnT	Single number value in dBA DnAT (pink noise or road traffic noise according to the reference used)

ISO standards	Apparent sound reduction index R'	Weighted apparent sound reduction index R'w	Raw level difference D	Normalised sound insulation Dn
Standard	ISO 140-4 (NF EN 140-4)	ISO 717-1 (NF EN 717-1)	ISO 140-4	ISO 140-4
Inputs	- 1 emitted noise spectrum - 1 received noise spectrum - 1 RT spectrum - Optionally, 1 background noise spectrum	- 1 apparent sound reduction index spectrum R'	- 1 emitted noise spectrum - 1 received noise spectrum - Optionally, 1 background noise spectrum	- 1 emitted noise spectrum - 1 received noise spectrum - 1 RT spectrum - Optionally, 1 background noise spectrum
Parameters	- V : Volume of reception room (m^3) - S : Area of the test specimen equal to the test opening (m^2)			- V : Volume of reception room (m^3)
Frequencies	- Octaves or third octaves	- Octaves or third octaves - The apparent sound reduction index spectrum R' must contain the frequency bands ranging from100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves	- Octaves or third octaves	- Octaves or third octaves
Computation	Equivalent absorption area A per frequency band: $A = (0.16 * V) / T$ (m^2) V : Volume of reception room (m^3) T : RT reception room Apparent sound reduction index per frequency band : $R' = L_1 - L_2 + 10 \lg(S/A)$ (dB) L_1 : Emitted noise spectrum L_2 : Received noise spectrum S : Test area If background noise spectrum as an input, there is an additional correction. (Cf (3))	Computation is carried out taking into account the frequency bands ranging from 100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves. The reference curve (cf table 3) is shifted in steps of 1 dB towards the measured curve (R' spectrum) until the sum of the unfavourable deviations is as large as possible but no more than 32.0 dB (2.0 dB per frequency band – 16 bands) in third octaves and 10.0 dB (2.0 dB per frequency band – 5 bands) in octaves. An unfavourable deviation at a particular frequency occurs when the result of measurements is greater than the reference value. Only the unfavourable deviations are taken into account. The max. unfavourable deviation at any frequency should be recorded if it exceeds 8.0 dB After the progressive curve shifting, R'_w (dB) is the value of the reference curve at 500 Hz.	Per frequency band : $D = L1 - L2$ (dB) L1 : Emitted noise level L2 : Received noise level If background noise spectrum as an input, there is an additional correction. (cf (3))	Per frequency band : $D_n = D - 10 \lg (0.16*V / T*A_0)$ (dB) V : Volume of reception room (m^3) T : RT reception room A_0 : Reference equivalent absorption area (10 m^2) If background noise spectrum as an input, there is an additional correction. (cf (3))
Result	Result per octave or third octave bands, over the whole frequency of the input spectra quantities R'	Single number value in dB R'_w	Result per octave or third octave bands, over the whole frequency of the input spectra quantities D	Result per octave or third octave bands, over the whole frequency of the input spectra quantities D_n

ISO standards	Weighted normalised sound insulation Dn,w	Standardised sound insulation Dn,T	Weighted standardised sound insulation Dn,T,w
Standard	ISO 717-1	ISO 140-4	ISO 717-1
Inputs	- 1 Normalised sound insulation spectrum Dn	- 1 emitted noise spectrum - 1 received noise spectrum - 1 RT spectrum - Optionally, 1 background noise spectrum	- 1 standardised sound insulation spectrum Dn,T
Parameters		Reference RT	
Frequencies	- Octaves or third octaves - The Dn spectrum must contain the frequency bands ranging from100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves	- Octaves or third octaves	- Octaves or third octaves - The DnT spectrum must contain the frequency bands ranging from100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves
Computation	Computation is carried out taking into account the frequency bands ranging from 100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves. The reference curve (cf table 3) is shifted in steps of 1 dB towards the measured curve (Dn spectrum) until the sum of the unfavourable deviations is as large as possible but no more than 32.0 dB (2.0 dB per frequency band – 16 bands) in third octaves and 10.0 dB (2.0 dB per frequency band – 5 bands) in octaves. An unfavourable deviation at a particular frequency occurs when the result of measurements is greater than the reference value. Only the unfavourable deviations are taken into account. The max. unfavourable deviation at any frequency should be recorded if it exceeds 8.0 dB After the progressive curve shifting, $D_{n,w}$ (dB) is the value of the reference curve at 500 Hz.	Per frequency band : $D_{n,T} = D + 10 \lg (T / T_0)$ (dB) T : RT reception room T0 : Reference RT value If background noise spectrum as an input, there is an additional correction. (cf (3))	Computation is carried out taking into account the frequency bands ranging from 100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves. The reference curve (cf table 3) is shifted in steps of 1 dB towards the measured curve (DnT spectrum) until the sum of the unfavourable deviations is as large as possible but no more than 32.0 dB (2.0 dB per frequency band – 16 bands) in third octaves and 10.0 dB (2.0 dB per frequency band – 5 bands) in octaves. An unfavourable deviation at a particular frequency occurs when the result of measurements is greater than the reference value. Only the unfavourable deviations are taken into account. The max. unfavourable deviation at any frequency should be recorded if it exceeds 8.0 dB After the progressive curve shifting, $D_{n,T,w}$ (dB) is the value of the reference curve at 500 Hz.
Result	Single number value in dB $D_{n,w}$	Result per octave or third octave bands, over the whole frequency of the input spectra quantities $D_{n,T}$	Single number value in dB $D_{n,T,w}$

ISO standards (cont'd)	Raw acoustic insulation D	Standardised sound insulation D_n	Standardised sound insulation $D_{n,T}$	Apparent transmission loss index R'
Standards	ISO 10052	ISO 10052	ISO 10052	ISO 10052
Inputs	- 1 emission spectrum - 1 reception spectrum	- 1 emission spectrum - 1 reception spectrum - 1 reverberation index spectrum	- 1 emission spectrum - 1 reception spectrum - 1 reverberation index spectrum	- 1 emission spectrum - 1 reception spectrum - 1 reverberation index spectrum
Parameters		- V: Volume of the receiving room (m^3)		- V: Volume of the receiving room (m^3) - S: Area of the specimen equal to that of the test opening (m^2)
Frequencies	Octave From 125Hz to 2kHhz	Octave From 125Hz to 2kHz	Octave From 125Hz to 2kHz	Octave From 125Hz to 2kHz
Calculation	By frequency band: $D = L1 - L2$ (dB) L1: Emission level L2: Reception level	By frequency band: $D_n = D + k + 10 \lg (A_0 * T_0 / 0.16V)$ (dB) V: Volume of the receiving room T_o: reference reverberation time (0.5s) A_0: reference absorption area (10 m^2) k: reverberation index	By frequency band: $D_{n,T} = D + k$ (dB) k: reverberation index	By frequency band: $R' = D + k + 10 \lg(S * T_0/0.16V)$ (dB) k: reverberation index S: specimen area T_o: reference reverberation time (0.5s) V: Volume of receiving room
Results	Result by octave over the entire frequency range of input spectra D	Result by octave over the entire frequency range of input spectra D_n	Result by octave over the entire frequency range of input spectra $D_{n,T}$	Result by octave over the entire frequency range of input spectra R'

10.2 IMPACT NOISE

French standard	Normalised impact sound pressure level LnT	A-weighted normalised impact sound pressure level LnAT
Standard	NF S 31-057	NF S 31-057
Inputs	- 1 received impact noise spectrum (received noise level of test floor excited by a standardised tapping machine). - 1 RT spectrum - Optionally, 1 background noise spectrum	- 1 normalised impact sound pressure level LnT
Parameters	Reference RT value	
Frequencies	- Octaves or third octaves	- Octaves or third octaves - The L_{nT} spectrum must contain the frequency bands ranging from100 to 5000 Hz in third octaves and 125 - 4000 Hz in octaves
Computation	Per frequency band : $L_{nT} = L_i - 10 \lg (T / T_0)$ (dB) L_i :Received impact noise (raw impact noise level) T : RT reception room T0 : Reference RT value The lower limit of the T duration is 0.4 s. If the measured value is less than this limit, T=0.4s for the calculation. If background noise spectrum as an input, there is an additional correction. (cf (1))	Computation is carried out taking into account the frequency bands ranging from 100 to 5000 Hz in third octaves and 125 - 4000 Hz in octaves. j : indice of the frequency band m : 6 for octaves measurements 18 for third octaves measurements Cj : A weighting value for the frequency band j (Cf Table 2) LnTj : Value of the normalised impact sound pressure level for the frequency band j $L_{nAT} = 10 \lg \left(\sum_{j=1}^{m} 10^{(LnTj + Cj)/10} \right)$ (in dBA)
Limitations	Cf background noise correction (1)	
Result	Result per octave or third octave bands, over the whole frequency of the input spectra quantities L_{nT}	Single number value in dBA L_{nAT}

ISO standard	Normalised impact sound pressure level L'n	Weighted normalised impact sound pressure level L'n,w	Standardised impact sound pressure level L'nT	Weighted standardised impact sound pressure level L'nT,w
Standard	ISO 140-7	ISO 717-2	ISO 140-7	ISO 717-2
Inputs	- 1 received impact noise spectrum (received noise level of test floor excited by a standardised tapping machine). - 1 RT spectrum - Optionally, 1 background noise spectrum	- 1 normalised impact sound pressure level L'n spectrum	- 1 received impact noise spectrum (received noise level of test floor excited by a standardised tapping machine). - 1 RT spectrum - Optionally, 1 background noise spectrum	- 1 standardised impact sound pressure level L'nT spectrum
Parameters	- V : Volume of reception room (m^3)		Reference RT	
Frequencies	- Octaves or third octaves	- Octaves or third octaves - The L'n spectrum must contain the frequency bands ranging from100 to 3150 Hz in third octaves or 125 - 2000 Hz in octaves	- Octaves or third octaves	- Octaves or third octaves - The L'nT spectrum must contain the frequency bands ranging from100 to 3150 Hz in third octaves or 125 - 2000 Hz in octaves
Computation	Per frequency band : $L_n = L_i + 10 \lg (0.16*V / T*A_0)$ (dB) L_i :Received impact noise (raw impact noise level) V : Volume of reception room (m^3) T : RT reception room A_0 : Reference equivalent absorption area (10 m²) If background noise spectrum as an input, there is an additional correction. (cf (3))	Computation is carried out taking into account the frequency bands ranging from 100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves. The reference curve (cf table 4) is shifted in steps of 1 dB towards the measured curve (L'n spectrum) until the sum of the unfavourable deviations is as large as possible but no more than 32.0 dB (2.0 dB per frequency band – 16 bands) in third octaves and 10.0 dB (2.0 dB per frequency band – 5 bands) in octaves. An unfavourable deviation at a particular frequency occurs when the result of measurements is less than the reference value. Only the unfavourable deviations are taken into account. After the progressive curve shifting, $L'_{n,w}$ (dB) is the value of the reference curve at 500 Hz.	Per frequency band : $L'_{nT} = L_i - 10 \lg (T / T_0)$ (dB) L_i :Received impact noise (raw impact noise level) T : RT reception room T0 : Reference RT value If background noise spectrum as an input, there is an additional correction. (cf (3))	Computation is carried out taking into account the frequency bands ranging from 100 to 3150 Hz in third octaves and 125 - 2000 Hz in octaves. The reference curve (cf table 4) is shifted in steps of 1 dB towards the measured curve (L'nT spectrum) until the sum of the unfavourable deviations is as large as possible but no more than 32.0 dB (2.0 dB per frequency band – 16 bands) in third octaves and 10.0 dB (2.0 dB per frequency band – 5 bands) in octaves. An unfavourable deviation at a particular frequency occurs when the result of measurements is greater than the reference value. Only the unfavourable deviations are taken into account. After the progressive curve shifting, $L'_{nT,w}$ (dB) is the value of the reference curve at 500 Hz.
Result	Result per octave or third octave bands, over the whole frequency of the input spectra quantities L'_n	Single number value in dB $L'_{n,w}$	Result per octave or third octave bands, over the whole frequency of the input spectra quantities L'_{nT}	Single number value in dB $L'_{nT,w}$

10.3 EQUIPMENT NOISE

French standard	Normalised equipment noise level LeT
Standard	NF S 31-057
Inputs	- 1 equipment noise level in dBA (received noise level when the equipment is working) - 1 RT spectrum
Parameters	Reference RT value
Frequencies	- Octaves or third octaves - Le input RT spectrum must contain at least the frequency bands 250Hz and 500 Hz
Computation	$L_{eT} = L_e - 10 \lg (T / T_0)$ (dBA) L_e : Raw equipment noise level T : RT reception room T_0 : Reference RT value T is defined as the arithmetic average of the measured reverberation time in the frequency bands 250 and 500 Hz.
Result	Single number value in dBA L_{eT}

10.4 BACKGROUND NOISE CORRECTION

(1) : Background noise correction for NF S 31-057 French Standard
When the level difference between the noise source level and the background noise level lies in the range 5 to 7 dB (limits included), 1 dB has to be subtracted to the measured values.
If the level difference is less than 5 dB, the measurement is considered as not significant. However, if the quality requirements of the measurement have been fulfilled, the result may be obtained

(2) : Background noise correction for ISO 140-3 and ISO 140-6 standards
If the level difference is less than 15 dB but greater than 6 dB, the background noise correction factor is given by the formula :

$$\mathbf{L} = 10 \lg (10^{Lsb / 10} - 10^{Lb / 10})$$

L : Corrected noise level (dB)
Lsb : Combined signal and background noise level
Lb : Background noise level

If the level difference is less than 6 dB, for any frequency band, the background noise correction is equal to 1,3 dB. This correction correspond to a level difference of 6 dB.

(3) : Background noise correction for ISO 140-4 and ISO 140-7 standards
If the level difference is less than 10 dB but greater than 6 dB, the background noise correction factor is given by the formula :

$$\mathbf{L} = 10 \lg (10^{Lsb / 10} - 10^{Lb / 10})$$

L : Corrected noise level (dB)
Lsb : Combined signal and background noise level
Lb : Background noise level

If the level difference is less than 6 dB, for any frequency band, the background noise correction is equal to 1,3 dB. This correction correspond to a level difference of 6 dB.

10.5 TABLES OF VALUES USED FOR THE STANDARD CALCULATIONS

Table 1 –Sj reference spectrum values for road traffic noise (standard NF 31 057)

Frequency	Sj values per third octave band (dB)	Sj values per octave band (dB)
100	66	71
125	66	
160	66	
200	65	70
250	65	
315	63	
400	62	66
500	61	
630	61	
800	61	65
1000	60	
1250	59	
1600	59	63
2000	58	
2500	56	
3150	54	57
4000	52	
5000	50	

Note : For pink noise reference spectrum, this value is constant whatever the frequency band.

Table 2 –Cj values for A-weighting for computation of single number values in dB(A) (standard NF 31 057)

Frequency	Cj values per third octave band (dB)	Cj values per octave band (dB)
100	-19,1	-16
125	-16,1	
160	-13,4	
200	-10,9	-8,5
250	-8,6	
315	-6,6	
400	-4,8	-3
500	-3,2	
630	-1,9	
800	-0,8	0
1000	0	
1250	0,6	
1600	1	1
2000	1,2	
2500	1,3	
3150	1,2	1
4000	1	
5000	0,5	

Table 3 – Reference values for airborne noise (ISO standard)

Frequency	Reference value per third octaves (dB)	Reference value per octaves (dB)
100	33	36
125	36	
160	39	
200	42	45
250	45	
315	48	
400	51	52
500	52	
630	53	
800	54	55
1000	55	
1250	56	
1600	56	56
2000	56	
2500	56	
3150	56	

Table 4 – Reference values for impact sound (ISO standard)

Frequency	Reference value per third octaves (dB)	Reference value per octaves (dB)
100	62	67
125	62	
160	62	
200	62	67
250	62	
315	62	
400	61	65
500	60	
630	59	
800	58	62
1000	57	
1250	54	
1600	51	49
2000	48	
2500	45	
3150	42	

Chapter 11
ACCESSORIES

A number of accessories are used for building acoustics measurements, including noise sources:
- Unidirectional and omnidirectional airborne noise sources
- Tapping machine
- Tripod
- Facade measurement poles
- Microphone extenders, etc.

The following sections describe the noise sources:

Note: *See the accessories data sheets for more information.*

11.1 TAPPING MACHINE TM01

The **TM01** tapping machine consists of an aluminium frame standing on 3 rubber feet, the height of which can be adjusted. It includes a camshaft that drives 5 hammers with a mass of 500g each, set 10 cm apart one from another. The **TM01** machine allows for the hammers falling from a 40-mm effective height with a time interval of 100 ms between the drop of each hammer.

The **TM01** machine includes a lead-acid gel battery that allows for an optimum and standardised continuous operation time of 2 hours.

A pushbutton is used to manage the operation of the machine. Depending on the length of time the button is pressed, the following actions can be achieved:
- Power-up of the machine: Short push (< 850 ms)
- Operating for 5 min: Short push
- Operating for 20 min: Long push (850-2,500 ms)
- Turn-off of the machine: Long push (> 2,500 ms)

The **TM01** machine is supplied with a radio frequency remote control that allows for remote start and stop. The remote control is effective through the walls and floors normally built in residential and office buildings (the emitter's range in direct field is greater than 100 m).

11.2 OMNIDIRECTIONAL NOISE SOURCES LS01/LS02

01dB offers 2 omnidirectional sources, **LS01** and **LS02**, compliant with standards ISO 140 and ISO 3382.

Both sources have the same design. They consist of a 12-loudspeaker dodecahedron and contain each:

- a power amplifier
- a noise generator

Robust, compact and easy to implement, both sources **LS01**/**LS02** can be driven using a remote control. In addition to starting and stopping the sources, the user can control:

- the volume level by +/-2 dB steps or with a known gain (0 dB, -8 dB, -30 dB…).
- the type of noise: pink, white, swept sine according to different frequency ranges

The **LS01** source is delivered with a battery pack that provides more than 1 hour of operating time.

11.3 NOISE SOURCE GDB-S

GDB-S is a compact unidirectional noise source including the following main elements:

- a power amplifier
- a pink noise generator
- a speaker

Hosted in a robust chassis, GDB-S is powered up by batteries that provide the user with 10 hours of continuous operating time.

The user can use the wireless remote control provided in order to start and stop the source.

Chapter 12
TECHNICAL SPECIFICATIONS

12.1 FUSION/DUO SOFTWARE

Product Code
FSN2009000: Building option for **FUSION**
DUO2022000: Building option for **DUO**

Frequency-based analysis
1/1 or 1/3 octave, 50 to 5000 Hz

Levels L_1, L_2, L_i (Emission, Reception, Impact noise)
Calculation of the mean spectrum LZeq over the specific coding duration, recognized automatically (source on duration)

Background noise level L_b
Calculation of the mean spectrum over the entire measurement duration

Integration times (IT)
1 second; 20 milliseconds

Maximum averaging time for spectra L_1, L_2, L_b and L_i
120 seconds

Maximum measurement time for equipment noise
600 seconds

Simultaneous audio recording
Sampling frequency: 51.2 kHz, 25.6 kHz, 12.8 kHz, 6.4 kHz, 3.2 kHz, 1.6 kHz

Equipment noise levels
Selection of the maximum level for one of the following parameters: LXYMax where X = A, C or Z and Y = F, S or I

Calculation of reverberation times
Fast logging period 20 ms for decay analysis
Simultaneous calculation of T20 and T30
Automatic recognition of interrupted or pulsed noise sources
Schroeder integration for pulsed sources
Estimate by least squares approximation

Calculation of quality indicators (ISO 3382)

	Indicator	Description
	Background noise level too high*	Low dynamic range (between 41 and 45 dB for T30; between 31 and 35 dB for T20)
	Calculation impossible*	Insufficient dynamic range (< 41 dB for T30; < 31 dB for T20)
	Reverberation time too low	Tr < 0.24 seconds (scaled by logging period = 20 ms)
	Non-linearity*	Non-linearity parameter ξ >1%
	Curvature*	C > 10% or C < 0; see [1] appendix B.3
	Linearity of the sound source linearity	Difference between adjacent 1/1 or 1/3 octave bands > 6 dB

*: ISO 3382-2 standard indicator

Invalid indicators displayed on the Tr spectrum and stated on decay

Audio comments
Used to store a voice comment, with the same sampling frequency as for the measurement

12.2 dBInside software

Product Code
SBU2001000: **dBInside** software for PC
SBU3001000: dBBATI to **dBInside** update

Language
French
English

Data transfer
- USB interface
- Ethernet interface
- Wi-Fi link
- SD card reader

Organization
All measurements and results are displayed in a three-level table:
- Results of the standardized calculation for a test in accordance with the selected standard
- Result of the average level of all measurements of a given type for a single test
- Individual measurement for each microphone position

Display of spectral values
1/1 or 1/3 octave level types
A cursor can be used to display the values for each band.

Display of reverberation times
For reverberation time measurements, the decay values for each frequency band measured can be displayed.

List of values
The values of each result or measurement may be displayed as a table of values.

OutputGgraphical or tabular; may be printed directly.
It is also possible to copy and paste images and values into office tools such as the Microsoft® Office suite.

Reports
Reports are generated via an interface with Microsoft® Excel 2010.
All reports may be customized by the user.

ACOEM
Smart monitoring, diagnosis & solutions

ACOEM offers comprehensive products and services comprising smart monitoring, diagnosis and solutions, drawing upon its unique expertise in the field of vibrations and acoustics.

ACOEM contributes to the improvement of:

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- **protection of sites, vehicles and people in hostile environments**

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